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JULY, 1942

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Number 3

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Ten Calves Per Year from One Cow .... *Guernsey Breeders' Journal* 1
New Methods Save Labor in Haying ..... *Capper's Farmer* 3
The Sweep Rake ..... *American Agriculturist* 7
Plants That Kill ..... *The Cattleman* 9
A Production Test for Sheep ..... *Successful Farming* 14
What Shall I Charge? ..... *The Farmer* 16
Fertilizing for Permanent Hay ..... *Better Crops* 19
Heavier Grain Feeding to Increase Milk ..... *Western Farm Life* 27
Cutting Labor Corners ..... *Farm Science Reporter* 30
Profitable Air Conditioning ..... *American Poultry Journal* 33
Cover Crop Problems in Orchards ..... *American Fruit Grower* 37
Feeding Trials ..... *Missouri Ruralist* 41
Getting Summer Eggs ..... *Poultry Item* 43
Fertilizers Will Help ..... *Michigan Farmer* 47
Reviving An Ancient Industry ..... *New England Homestead* 51
Figuring the Farm's Beef Power ..... *Kansas Farmer* 53
Chickens on Shares ..... *Farm Journal and Farmer's Wife* 57
Hay Cutting Time Vital ..... *Missouri Farm News* 60
Conservation Farming and Yields ..... *Soil Conservation* 61
Vitamin B in Swine Nutrition ..... *Hog Breeder* 67
Sulfur and Charcoal Prevent Coccidiosis ..... *Pacific Rural Press* 69
Wild Horses of the Plains ..... *W. O. Roberts* 71
Principles of Disease Control ..... *Shorthorn World* 75
Making Cheese at Home ..... *Texas Farming and Citriculture* 79
For the Farmer's Library 85

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The Farmer's Digest

Volume 6 July, 1942 Number 3

Ten to Twenty Calves Per Year from One Cow

Condensed from Guernsey Breeders' Journal

John B. Deavours

First Lieutenant, Air Corps, Public Relations Officer, Napier Field, Dothan, Alabama

NO, the heading above is not a misprint! The answer to the question is found in the experimental work carried on by Aviation Cadet, Raymond Umbaugh, before he joined the Air Corps—a scientific discovery that possibly will change the history of animal husbandry as much as Columbus' discovery of America changed the history of the world. Heretofore, the experiments, which have been conducted in co-operation with the U. S. D. A., have been surrounded by utmost secrecy. However, the process is now fully protected, and at this date is offered for publication for the first time.

The United States Department of Agriculture in Washington was very interested in this new process of mating and breeding, and Cadet Umbaugh left in February for Washington for consultations at the request of the Animal Husbandry Department of the Department of Agriculture as there was a strong possibility of the government taking charge of his discovery for further experimentations and use.

Cadet Umbaugh explains very clearly this intricate process of reproduction in simple "layman" language:

"The technique which has been developed will permit dairymen to produce 10 to 20 calves per year from a single high producing cow instead of the usual one. For example, if a dairyman has a thousand-dollar cow and access to a thousand-dollar sire, he will be able to produce 10 to 20 calves per year from this mating. This is done by transferring the developed ova (eggs) from the

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high producing cow to scrub cows and mating the scrub cows to the thousand-dollar sire. During the heat period a cow produces one egg which can with very little difficulty be removed and transferred to another cow. In three weeks she will produce another egg and she will continue to produce an egg every three weeks until she is mated and becomes pregnant.

"By the use of hormones, we may be able to force a cow to produce as high as 25 or 30 eggs per year instead of the usual 17; all of which would be transferable. The genetical make-up of a calf depends upon the sperm and the egg and to no extent upon the uterus in which it has been developed; that is to say, the blood of the scrub cows which develops the egg of the high price cow will have no effect upon the heredity of the offspring.

"By the use of egg transfers, dairymen could in a few years replace all their scrub stock with registered high producing cattle. Egg transfers are possible and this technique will probably be extended to include all species of livestock and other animals as well."

Cadet Umbaugh is a graduate of Purdue University at Lafayette, Indiana, in the School of Animal Husbandry. However, most of the experiments have been carried on in Umbaugh's own private laboratory.

Alfalfa Yellows Cure

Tests in James City county, Virginia, showed 10 pounds of borax increased the yield of alfalfa 4,693 pounds of dry hay an acre the first two years the stand was down. Both check and test plots got an application of 1 ton of limestone and 800 pounds of 0-14-6 fertilizer an acre at seeding time in September, 1939, and the borax was applied at the same time.

Stands of alfalfa in the area had been affected by what was known as "alfalfa yellows," and deteriorated rapidly after the second year. Leaves would yellow, stems would become short and stunted in second and third cuttings, and crab grass and weeds would come into the field.

Plants treated with borax, both at the James City County Experiment Station and at another in Pittsylvania county, remained green and bloomed profusely despite a long spring drouth in 1941, while untreated plots were stunted and yellowish in color.

—Capper's Farmer

New Methods Save Labor in Haying

Condensed from Capper's Farmer

HAYMAKING has lagged in the mechanization of farm operations. By far the big end of the acreage still is harvested and stored by methods in use half a century ago. And those laborious methods have aggravated a bottleneck which has grown more and more constricted as areas of sod crops have been forced upward by adjustment programs. Under a farm-labor shortage made more acute by draft and war industries, hay harvest becomes an even greater problem for the duration. And the situation is further complicated because most of the food production increases demanded involve enterprises which require a maximum of chores.

Interest in haying is as widespread as the acreage of land devoted to it. F. W. Duffee, University of Wisconsin agricultural engineer, asserted: "Hay is probably the most universal crop grown in the United States. It is grown in every state, ranging from 5 per cent of the cropland in Florida and Texas up to 92 per cent in New Hampshire. In Wisconsin, hay utilizes 4 of every 10 acres of cropland, and this state with Michigan and Minnesota are the 3 leading states in the production of alfalfa."

Altho mechanization of haying has not been completed to the extent that a set of machines has been devised to eliminate all human drudgery as in the case of corn and small grain production, still much progress has been made by individual farmers. Capper's Farmer has gathered information on labor-saving practices from many farmers in several states, east, north, south and west. While the devices and methods they have adopted are not universally applicable, some of them offer suggestions for reducing the peak load and spreading the job.

For instance, Michigan, Indiana, and Ohio farmers have taken a tip from Nebraska hay growers and adapted the motorized buck to their needs. These bucks are mounted on the rear of an old automobile or motor truck chassis. In field stacking, chopping or baling, the Nebraskans reverse the gears and the direction of operation so that the altered machine steers from the rear and has 3 forward speeds in what was formerly reverse. The Eastern farmers leave the gears unchanged, back into the windrows to load, and use the normal forward speeds in hauling from field to barn.

Reprinted by permission from Capper's Farmer, Topeka, Kansas, May, 1942

C. Ray Dunifon, Van Wert county, Ohio, asserts such a buck enables him to put up 3 times as much hay as he formerly did with wagons and loader. The buck will load 800 to 1,000 pounds. It is 10 feet wide, teeth are 12 feet long and the back is 5 feet high. By cable lift it tips up 4½ feet at such angle that the hay is safely cradled against slipping off. At the barn it is dumped on slings for hoisting to the mow. The crew, 1 man on the buck rig, 1 to hook slings and attend the hoist and 1 or 2 men in the mow is about the same as he would use otherwise. Said Mr. Dunifon: "This buck really makes the power mower effective, because it takes the hay up faster. A man with tractor mower will lay down 3 times as much acreage in a given time as he will with a horse mower. The power buck will get the hay in proportionately as fast over old methods."

Mr. Dunifon also uses the buck for bringing in fodder. "I no longer set the fodder up in the field after the corn has been husked," he explained, "but pile the bundles, run under them with the buck and take them in to be shocked near the feedyard. One setting up does the job. Once I loaded more shocks than I could have put on a 16-foot rack.

A long wheelbase and a heavy motor is an advantage in this kind of buck. Nebraska farmers assert that in stacking, field baling or chopping and in transporting shocked grain to the thresher the motorized buck will replace 2 or 3 teams and as many men.

George Konicek, Benton county, Iowa, uses a tilt-platform truck in hauling hay from field to chopper at the barn. The device works like a dump body. Sides are let down to widen the platform. In loading, the back end of the platform is tilted to the ground and hay is pushed on with a tractor buck rake.

A speedy unloading job can be done by the roll-in or roll-off method which has been promoted extensively by members of the Northwest Farm Managers' Association. The mow hay door is enlarged to take an entire truck or wagon load of hay which is backed up to the end of the barn. By use of slings and barn ropes the roughage is rolled into the mow. Chutes or slides of varying lengths, extending from the mow opening to the hayrack are sometimes provided and sometimes not. Adaptations of this method are employed in stacking. The hay may be loaded on either trucks or wagons and rolled on to the end of the stack or it may be bucked on to ropes.

Chopping is another labor-saving method of making hay. If the hay loader is used, all hand labor except a man on the wagon and 1 or 2 men to pitch into the cut-

ter is eliminated. Nobody is needed in the mow. If some such device as Mr. Konicek's truck is used, the wagon loader is not needed. J. H. Curtis, Van Buren county, Michigan, asserted that in feeding the cutter, he had replaced 4 men of an ordinary hay crew. Further labor savings are forthcoming in feeding the chopped hay.

Stacking chopped hay in the field also speeds haying, and to the extent that it shortens the haul during a busy season, it also relieves the peak labor load. Bass Brothers, Boone county, Missouri, have stacked and fed chopped hay in the field for several years. They use snow fencing for forms and remove them when stacks have settled. D. H. Hunter, Hamilton county, Iowa, uses only 1 ring of cribbing and pulls it up as stacking proceeds. The chopped hay is tramped firmly into the mold and no bulging or caving occurs when it is raised.

Jacob Mueller, Harvey county, Kansas, chops as much hay as possible into the barn and then stacks the rest in the field to be hauled in during the slack periods of fall and winter. To provide aeration of the chopped haystack he makes a ventilator by fastening two 6-inch fence boards together, 6 inches apart with cleats. Onto the cleats he nails lath, 2 courses, to close the space of the 6-inch open sides. This ventilator 16 feet long is set up in the center of the ring when filling starts. His stacks are 16 feet in diameter and contain at least 25 tons.

The field baler offers essentially full mechanization of haying. Raymond Obermyer, Williams county, Ohio, asserts that 3 men will put two-hundred-fifty 100-pound bales under cover in an afternoon with his pickup press. J. A. Worthy, Navarro county, Texas, operates his pickup press with 3 men, who will bale twice as much hay as a 9-man crew did with an old stationary press. Ed. Jerwers, Putnam county, Ohio, has rigged an elevator on a motor truck which saves labor in stacking or storing bales.

Picking up packaged hay from the ground has been eliminated by some farmers. These operators hitch low-platform, rubber-tired trailers behind their portable pickup balers. Hay is pushed along a slide to the platform. A man rides the trailer to stack bales.

When a trailer is loaded, Lang replaces it with an empty one, and the load goes to the hay shed. One farmer uses a 2-wheel trailer with tilting platform. It is loaded so center of weight is behind the axle. When fully loaded, a keeper at the front is released, the platform tilts and bales, piled to interlock, slide off the rear properly stacked for further field curing.

Another recent development, the field chopper or forage harvester, goes a step farther in mechanical haymaking. Raking chopped hay into a blower is all the handwork required by the method Gilbert K. Miner uses in Sibley county, Minnesota. He has a portable cutter that picks up hay from the windrow, chops it and blows it into a covered wagon pulled behind the cutter. Miner can get along in a pinch with a 2-man crew, but the job is speeded when there is one to operate the chopper, another to tow the covered wagons from field to barn, and a third at the blower to unload.

One farmer uses a 4-man crew and puts up 4 tons an hour. Before he got a field chopper he used 8 men, and got in less hay. One man runs the cutter, one plies back and forth with a towing unit that pulls loads and empty wagons between cutter and barn, and the others unload.

A power crane at a stack yard adjacent to Charles Siemer's feed lots, LaSalle county, Illinois, reduced wagon unloading time a third and increased tonnage a stack 3 times. The crane would hoist the load from an 18-foot basket rack in one lift. It also was used for shifting hay into the feedlot, and for handling metal stack covers.

Where the hay acreage is extensive, a portable, self-powered overshot stacker like that built by Peterson Brothers, Garden county, Nebraska, saves labor and time. It is mounted on the chassis of an old motor truck, the front axle of which was strengthened and extended to give a tread width of 12 feet. A power takeoff built into the transmission operates the cable lift, which is speeded higher than most stacker lifts. When a stack is completed, the rack is lifted off the ground, the transmission is shifted into reverse, and stacker is backed away. Shifted then to forward gear, it moves quickly to the next location. With it and enough motor buck to keep it operating at full efficiency, the Petersons put up 250 tons of hay in a day. Their record is 27 stacks of 7½ tons each in one 6-hour afternoon.

By using the forage harvester and converting his green alfalfa into silage, Herb Albers, Cuming county, Nebraska, cattle feeder, has eliminated haymaking in the ordinary sense. The silage process is entirely mechanized. No hay is fed to his fattening cattle.

E. J. Newkirk, Adams county, Nebraska, by using chopped hay saves about 30 tons a winter over what his herd would require of long hay. That is just 30 tons that he does not need to put up and so he saves a proportionate amount of labor. Some farmers avoid part of the haying cost by

grazing the crops off. Dairymen in regions where alfalfa can be grazed with reasonable safety frequently hay the first-year stand and graze the second or they may cure the first cutting and pasture the remaining growth that season.

The Sweep Rake

A New Hay Making Tool

Condensed from American Agriculturist

Paul R. Hoff

Department of Agricultural Engineering, Cornell

THE sweep rake (also known as the buck rake) is a hay-making tool that is new to many farmers. It has been in use on a few farms during the past two or three years, and on these farms it has reduced the labor and time required for making hay. The rake is mounted on a stripped down auto, a "doodle-bug," or a tractor, and travels between the field and the barn at road speed.

Advantages

1. Labor Saving. The number of man-hours per ton required to put up hay with a sweep rake is less than the number required by either the hay loader and wagon or by the pick-up baler. Seven hundred to one thousand pounds of hay can be picked up in the field by the sweep rake at one load and transported to the barn at a higher speed than is possible on a wagon. The return trip is also at a speed that is higher than wagon travel. The time required for loading is but a fraction of that required to load a wagon.

A comparison of the labor requirements of different methods of hay making is shown in the table.

2. One Man Operation. One man operating the sweep rake can pick up the load, transport it to the barn and unload it without assistance. Should it be impossible to get a second man, several loads can be pulled up into the mow before the hay is mowed away. The efficiency of a one man crew is higher with a sweep rake than in any other method of haying.

3. Homemade. Sweep rakes can be put together by anyone

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who is handy with tools. Most of the material going into the construction is dimension lumber (2" x 4" or 4" x 4"), which is not critical war material. Several pieces of angle and channel iron are used and these pieces may be picked up at a junk yard or welder's shop if they cannot be found on the farm. The lifting mechanism can be made from the rear axle assembly of an old automobile.

Using the Sweep Rake

The sweep rake can be used efficiently both in hay making and in grain harvesting. In haying, the most common practice is to use the sweep rake in connection with a side-delivery rake and faster loading results if two windrows are thrown together. Hay is sometimes picked up directly from the swath, but this is a slower method.

Slings seem to be the most satisfactory for getting the hay into the mow, as the 700 to 1,000 pound load can be drawn up in one sling full. If the barn will not accommodate slings, the four prong grapple hook is the next best. The hay usually is too loose for handling with the two prong harpoon fork.

In the grain harvest, bringing shocks to the threshing machine is one job. Several shocks can be picked up at a time and carried to the machine. One or two sweep rakes, depending on the length of haul, can keep the machine busy and the labor of loading the wagons is eliminated. Handling combined straw is another chore for the sweep rake. Several windrows can be thrown together with the side-delivery rake, then picked up with the sweep rake and carried to the barn or the baler.

FIGURES ON HANDLING HAY BY DIFFERENT METHODS*

Method	No. of farms in Survey	Aver. tons hay per farm	Aver. No. of men in crew	Aver. tons per hr. by crew	Aver. man hrs. per ton
Wagon and Hay Loader ...	26	30	3.4	1.1	3.1
Auto Sweep Rake	84	41	3.1	1.8	1.7
Tractor Sweep Rake	53	35	2.6	1.3	2.0
Pick-up Baler	23	41	3.2	1.2	2.7

*Adapted from Mimeograph Bulletin No. 146, "A Study of the Newer Hay Harvesting Methods on Ohio Farms," by F. L. Morison, Department of Rural Economics, Ohio State University, Columbus, Ohio.

Plants That Kill

Condensed from The Cattleman

Oliver C. Lee

Extension Botanist, Purdue University, Lafayette, Indiana

POISONOUS plants may be considered the saboteurs of the plant kingdom. They are numerous and often inflict heavy livestock losses. During the past few years the interpretation of what constitutes a poisonous plant has been greatly broadened. In light of recent discoveries several cultivated plants under certain conditions have been included in the group. These discoveries have cleared up many puzzling livestock losses.

Fortunately, in most cases, livestock do not relish these dangerous plants. They often eat them merely because of the lack of other green forage. Early spring pasturing before the grass makes much growth or pasturing wooded areas during drouths should be avoided wherever poisonous plants are available to livestock. A knowledge of the poisonous plants of the territory and the symptoms exhibited by animals poisoned may help to determine the cause of the trouble in many cases.

Cases of mineral poisoning may be confused with plant poisoning. When livestock poisoning occurs on the farm, particularly if such a diagnosis is made by a veterinarian, a check should be made on the sources of mineral poisoning as well as for poisonous plants. Some of the most common causes of mineral poisoning are overdoses of salt, paint obtained from licking newly painted buildings or paint cans or drinking water from old paint cans, fertilizer, particularly nitrate of soda, arsenic obtained by grazing on grass under trees sprayed with arsenicals or from weeds and bushes sprayed with such poisonous materials. City garbage containing sulphur matches, soap powders, phosphorus, large quantities of coffee grounds or other poisonous materials may be the cause of the trouble.

If there is no evidence of mineral poisoning, a survey should be made to determine the presence of toxic plants. Symptoms exhibited by the poisoned animals should be kept in mind and used as a guide to determine the source of the trouble. Inasmuch as many poisonous plants are dangerous only in certain stages of growth and at certain times of the year, it would be well to keep this in mind when searching

Reprinted by permssion from The Cattleman, Ft. Worth, Texas

for the cause of the poisoning. Generally, densely wooded areas and ditch beds are most apt to harbor undesirable forage. This is not true, however, in the Western plains area where the loco weed and lupines are found in abundance on the open prairie.

When mentioning the poisonous plants the loco weed comes to mind. Loco, meaning crazy, is of Spanish origin, and this name was given to the plant because of the supposed effect on its victims. There are several species of loco plant, all common to the open range country of the West. Most of these plants suspected of being poisonous belong to the legume family to which belong alfalfa and the clovers. Probably the most common of the loco weeds causing trouble is the one known as the purple loco, which has a purple flower and very soft woolly leaves. It grows in patches and is a perennial weed, growing to a height of about one foot. The white loco can be distinguished from the purple loco by its long leaflets which grow erect rather than spreading. Even though it is called white loco the flowers are a deep dark shade of violet or purple. The third loco, or blue loco, sometimes called rattle weed, which is common in Arizona and New Mexico, differs considerably from the other two species. The leaflets are small and similar to those of alfalfa, the flowers are purple or violet.

All the locos produce similar symptoms in livestock. These appear only after somewhat prolonged feeding upon the plant. Ordinarily the first symptom of locoed animals is loss of condition. This is followed by irregularities of gait and weakness, which in many cases seems to cause paralysis. Animals show lack of co-ordination of muscular movement. Horses formerly gentle become uncontrollable and shy violently at imaginary objects. Generally speaking, a locoed horse can neither be lead nor handled. They are often difficult to stop and many continue until they run against a fence or some other obstruction.

Many animals may acquire a liking to this plant to such an extent that they will eat nothing else. This is not always true, however. Animals when affected often starve to death. It is not unusual for locoed cattle to remain for hours in one position or even days and finally fall and die without making an attempt to go elsewhere for food or water.

White snakeroot, a very common poisonous plant in the Middlewest, is found in wooded areas. It is responsible for heavy losses of sheep, cattle, horses and mules. Furthermore, milk sickness in humans may be contracted through milk from cows that have grazed freely on this

plant. The toxic substance called termatol enters the milk. Suckling young are also often poisoned in this manner.

White snakeroot may be recognized by the opposite broad leaves, each with three prominent veins. The under surface of the leaves is shiny in contrast to the dull upper surface. The flowers consist of a cluster of small bright white blossoms that appear in early fall. Under ordinary conditions the plant grows to a height of about three feet.

The outstanding symptoms of white snakeroot poisoning in livestock are severe trembling which is usually preceded by general listlessness, although the characteristic trembling may be absent in horses and mules. Death from weakness and exhaustion may occur in a few days or may be lingering. The fatal dose for mature cattle and horses is about ten pounds and for small animals about three pounds. White snakeroot poisoning in man is characterized by frequently vomiting of a green fluid with a strong odor of acetone on the breath resembling sewer gas, the occurrence of malaria symptoms without rise in temperature.

Water hemlock, the most deadly of poisonous plants, usually takes its toll in spring and again in early fall. The roots as well as the young shoots are deadly poisonous. Cattle, sheep and hogs turned on early pasture before there is a good bite of grass often graze along creek banks and wet places where water hemlock is commonly found. Water hemlock is a wet land plant. Again in the fall when pastures are short there is a temptation to graze on low wet land with disastrous results from the weed. Hogs are often poisoned by digging and eating the roots.

The water hemlock can be recognized by its tuberous, fleshy roots, usually branched, resembling a cluster of small sweet potatoes. The plants often grow to a height of from four to five feet with clusters of white flowers forming at the end of the branches. The leaves are small with distinct notches along the edges, almost to the point of being saw-like. Another characteristic of water hemlock is the purple coloring on the stems, especially at the points where branches occur.

Livestock poisoned by water hemlock usually exhibit symptoms of nervousness followed by muscular twitching that soon develops into severe convulsion. They often run in circles until exhausted and death occurs within a few hours.

Another dangerous plant found along ditch banks and in wet low land is the common cocklebur. If animals develop staggers and throw their heads backward in a

peculiar fashion, look for cocklebur sprouts as the cause of the trouble. If some of the animals are still sick, administering cream, milk, fats or oils may help them to recover. Investigations have shown that the cocklebur is only poisonous in the early, two-leaf stage of growth. This is rather unfortunate because it is only in that stage of growth that livestock will eat them. Livestock, particularly pigs, should not be allowed to graze on areas infested with cocklebur following warm weather in the spring when the burs germinate in abundance.

The wild cherry, a common tree in all parts of the country, is often the cause of livestock losses. The young shoots are poisonous at all times while the leaves of the tree are only dangerous after they have wilted. Poisoning by wild cherry usually occurs when livestock are permitted to graze on cut over land or when a storm breaks down branches causing the leaves to wilt.

The poisonous property of wild cherry is prussic acid, a very deadly material, causing animals to show symptoms of staggering, difficult breathing, dilation of the eyes, convulsions and falling, followed by coma and death. As small a quantity as one pound of foliage may prove fatal. There is evidence of the value of corn syrup and milk as an antidote, although the toxic effect may be so rapid as to render remedies useless.

Several other plants are also poisonous and bear watching. Among these are the common buck-eye, the leaves and sprouts of which are poisonous. Dwarf larkspur, Dutchman's breeches and the dwarf delphinium are potential sources of danger in wooded areas. Jimson weed, deadly nightshade, poke root, May apple, sneeze-weed, wild indigo, black-eyed Susan, water lily, buttercup, cockle, cat-tail, winter cress, whorled milkweed, star flower, red sorrel, and bull nettle are the cause of many mysterious livestock losses.

Numerous livestock losses due to mechanical plant injuries have been recorded. Hairballs of plant origin are usually caused by the accumulation of plant hairs as balls in the stomach of grazing animals. Occasionally these hairballs drop into the intestines, causing stoppage that results in a particularly distressing and painful form of death. Any plant equipped with barbed hairs or beards, such as millet, barley, foxtail, cocklebur, and rabbit's foot clover may cause trouble of this character. The beards or awns of barley, foxtail, squirrel-tail grass and other similar plants often penetrate the mouth parts and lining of the digestive tract and cause serious inflammation.

They may also enter the eye, causing blindness.

A few of our cultivated plants that are not ordinarily harmful become dangerous to livestock under certain conditions. Alsike clover and rape cause what is sometimes termed as dew poisoning, characterized by sores and inflammation of white skin areas of farm animals. Ordinarily, animals so affected refuse to eat; there is a profuse drooling of saliva and swelling of the tongue, lips and side of the face, especially if the face is marked with white hairs. In other cases, a foot will swell and the animal begins to stamp and even bite at the painful area. Later, the area may slough out, leaving a bald scar.

Dew poisoning is not well understood but it seems to be confined to the white skin areas of cattle, sheep, hogs, mules and horses and is most severe when hot sunshine strikes animals that graze on certain plants. In addition to alsike and rape, such plants as St. John's wort, rye, barley and others are suspected.

Sudan grass, a very common pasture crop, as well as Johnson grass and other sorghums, are often the cause of livestock losses. It was thought at one time that these plants were only poisonous when stunted by frost or drouth. Recent experimental work has brought out the startling facts that the plant is poisonous in certain stages of growth. Cyanide, the poisonous material, was found to be high in short dark green plants. Second growth after pasturing or removal of hay crop was especially dangerous to pasture until it had reached a height of two feet or more. Fertility of the soil was found to be a factor in cyanide content of plants. Sudan grass should not be pastured until it is at least 18 inches high to minimize danger of poisoning.

Sweet clover, a harmless appearing plant, is the cause of a disease in livestock characterized principally by the loss of clotting power of the blood. Losses usually occur during the winter months among animals that have been fed sweet clover hay or silage. The first indications of trouble may be bleeding of the nose. A stiff, jerky gait develops and peculiar swellings appear on all parts of the body but principally above the flanks, back and sides. The animals go off feed and in severe cases, die. On account of the strange effect of sweet clover on the blood, surgical operations should not be performed on animals being fed sweet clover hay or silage although there seems to be little, if any, danger of harmful effects of sweet clover pasture. It is safer, however, to remove the animals from such pasture at least a month before castration or dehorning.

A Production Test for Sheep

Condensed from Successful Farming

Cameron Hervey

A LIVESTOCK record of performance is a method of selecting breeding stock on the basis of production rather than appearance. Testing a cow's milk for butterfat content is a record of performance. So is keeping track of the number of eggs produced by a hen, and the size and weight of a litter of pigs.

Selection of breeding animals by a record of performance is more accurate than selection by appearance. Appearance is sometimes deceiving. The grand champion cow on the tanbark is not always the grand champion at the milk pail. The typy sow does not always produce the biggest litter of pigs; nor do her pigs always make the fastest and most economical gains in the feed lot.

And sheep-selection by appearance is no more reliable. The prize-winning ewe may be the poorest mother, and selection of the largest lambs for the breeding flock very often results in the elimination of the twinning characteristic.

Records of performance are being used more and more by progressive breeders of dairy cattle, hogs, and poultry; and beef-cattle-breeders are beginning to recognize their value. Why not, then, a record of performance for sheep?

But what should we consider when we are rating sheep for productive ability? How can we devise a record system simple enough to be practical for the average breeder?

The answers to these questions have been provided by R. J. Christgau of the Northwest Experiment Station at Crookston, Minnesota. Christgau has developed a record of performance for the station's Shropshires that he believes can be used by any breeder anxious to improve the efficiency of his flock.

For his record of performance, Christgau recommends a standardized plan of records and management. In general, it involves the following steps: 1. Numbering all individuals in the flock so that they may be identified easily. 2. Keeping a record of breeding dates. 3. Weighing the ewes at breeding or shearing time. 4. Recording the date of birth, weight, number, and sex of each lamb. 5. Weighing each lamb at weaning time and eight weeks after weaning time. 6. Determining individual fleece

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weights and grades. 7. Standardizing as nearly as possible all feeding, breeding, and management practices.

All this may seem like a lot of trouble, but the information obtained will enable the breeder to spot inefficient ewes and lambs more accurately than if he relied on appearance alone to select his breeding animals.

With Christgau's practical new record of performance, sheep-breeding need no longer be a matter of "b'guess and b'gosh." Dairymen are far in the lead with production-testing, and hog- and beef-cattle-producers have made rapid progress. Now would seem to be the time for sheep-breeders to get in the running.

An Inexpensive Barn Fan

SEVERAL dairymen in southeastern Iowa have constructed inexpensive, homemade fan systems that they use thruout the hot summer months. These have proved unusually popular from the standpoint of the comfort afforded both the cow and milker. Of course, electric current is required.

A rectangular frame or flue is built about 10 inches square and long enough to extend the entire length of the row of cow stalls. This is supported from the joists so as to hang about six to seven feet above the barn floor and just above the cows' hind-quarters. A high-speed, "squirrel-cage type" electric fan and motor are built into one end of this framework so that the air is blown thru to the other end, which is closed.

Openings about five inches square are sawed in the bottom board of this flue, spaced so as to line up at each stall partition. A slide parallel to the bottom of the flue and operated by cords is then built in to open and close the opening from below.

At milking time the switch is turned on. As each cow is milked, the slide nearest her in the direction of the fan is opened by the cord. A strong, cooling draft is then thrown down diagonally from this opening on both the milker and the cow, keeping flies from bothering the cow and allowing the milker to do his job in comparative comfort on the hottest summer days.

The initial cost and the operation of this system are not high. For sanitary reasons, the flue could easily be removed during the cooler months when it is not in use.—*F. C. Barney*

—*Successful Farming*

What Shall I Charge?

Condensed from The Farmer

IN our present war emergency, it is not only a patriotic duty for farmers to cooperate in using their machines to reach production goals, but it may be profitable machine management as well.

In the exchange of machinery, the first question that arises is, "What shall I charge or what will I have to pay?" The Extension Division at University Farm, St. Paul, has just issued Pamphlet 96 by A. J. Schwantes and Norton Ives, "Know Your Cost for Tractor and Machine Use," from which we are reproducing their table showing average cost of using the more common machines. We quote from the circular:

Tractor Use Costs

To determine tractor use costs, it is necessary to know the first cost, the estimated life in years, the rate of interest, and the amount of use per year. In the following example we assume that the first cost is $900.00, estimated life is 12 years, rate of interest is 6 per cent, and annual use is 450 hours. We further assume that the tractor has a drawbar rating of 16 horsepower, that the fuel consumption is 1.6 gallons per hour, and that the cost of lubricants is 2½ cents and that of repairs 4 cents per hour. Annual cost of tractor repairs has been found to average 2 per cent of the cost new.

Tractor costs may be divided into "fixed charges" and "operating costs." The fixed charges are those that remain relatively unchanged regardless of the actual number of hours of use per year. The operating costs are those that occur only when the tractor is operating.

Depreciation—Annual depreciation is the first cost divided by the estimated life in years or in this example $900 divided by 12 which equals $75.00. In estimating the life, assume a conservative life in keeping with conditions under which the machine will probably be used.

Interest—Interest is computed on the investment, which decreases as the machine depreciates. To determine in advance the annual interest cost of using a new machine, multiply the interest rate by the *average value* of the machine which is about one half the first cost. For the tractor in our example, this would be 6 per cent of $450.00 or $27.00.

Housing—The annual charge for a shelter including depreciation and upkeep is about 10 per

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cent of the first cost. For a shelter of about 1,000 square feet costing $300.00 to build, the annual charge would be $30.00 and the cost per square foot would be 3 cents. If the tractor occupies an area about 14x7 feet or 98 square feet, the annual cost of housing is $2.94.

Summary of Tractor Costs

Fixed Charges (Per Year)

Depreciation	$75.00
Interest	27.00
Housing	2.94
Total	$104.94
Fixed costs per hour ($104.94 ÷ 450)	$0.233
Fuel—1.6 gallons at 14c	$0.224
Lubricants (cylinder oil, transmission oil, and grease)	.025
Repairs (2 per cent of cost per year)	.04
Total operating cost per hour	$0.289
TOTAL COST PER HOUR	$0.522

Farm Machinery Use

The cost of using any farm machine may be found in a similar manner to tractors. Depreciation, interest, repairs, and housing are usually considered for machinery. In the example below we use a *grain drill* 10 feet wide costing $240.00. We assume the life to be 20 years, the interest rate to be 6 per cent, the annual acreage covered to be 90, and the number of acres seeded per day to be 15.

Depreciation ($240 ÷ 20)	$12.00
Interest ($120.00 x .06)	7.20
Repairs (½ per cent of cost new)	1.20
Housing (72 square feet x $0.03)	2.16
Total	$22.56
Cost per acre ($22.56 ÷ 90)	.25
Cost per day ($22.56 ÷ 6, days used)	3.76

The annual costs are as follows:

Depreciation is the largest fixed cost in machinery use. Annual depreciation can be reduced by increasing the useful life of machine by better care, more timely repairing, proper adjustments, adequate lubrication, and shelter.

The cost per hour can be reduced further by using the machine more hours each year.

Ways to Use Table

1. For approximate cost of using a machine for a day, use the figures in column 6.

2. If the cost new of your machine is different from the one given in column 1, multiply the cost new by the percentage figure in column 5. Since this gives the annual cost, divide by the number of days your machine is used for the cost per day.

3. To be still more thorough follow the method used in the illustration given in this article, substituting your own figures for the estimated life, interest rate, repairs, housing, and amount of use per year.

AVERAGE COST OF USING FARM MACHINERY

	1	2	3	4	5	6	7
Machine	Cost new	Average life in years	Repairs as per cent of cost new	Annual cost Total	Annual cost Per cent of cost new	Cost per day when used	Days used per year
Tractor plow (2-16")	$135	18	3.0	$17.22	12.8	$1.15	15
Tractor plow (3-16")	170	18	3.0	21.64	12.8	1.45	15
Disk harrow (15' single)	145	18	1.0	16.85	11.6	1.40	12
Spike-tooth harrow	45	20	1.5	4.45	9.9	.45	10
Field cultivator	140	15	1.5	18.51	13.2	1.30	14
Tractor cultivator 2 row	110	16	2.0	13.37	12.1	.90	15
Tractor cultivator 4 row	240	16	2.0	28.75	12.0	2.90	10
Grain drill tractor hitch 10ft.	240	20	0.5	22.56	9.4	3.76	6
Corn planter 2 row	85	18	1.5	9.62	11.3	1.60	6
Mower 6 foot	95	18	3.0	12.17	12.8	1.20	10
Side delivery rake	125	18	1.0	15.85	12.7	2.65	6
Hay loader	140	18	1.0	14.94	10.7	1.85	8
Grain binder (Tractor)	340	18	1.5	38.28	11.3	4.80	8
Corn binder 1 row (Tractor)	340	18	1.0	35.02	10.3	5.85	6
Combine (6 ft. Aux. Motor)	900	10	2.0	138.31	15.4	9.25	15
Corn picker 2 row	700	12	1.0	89.65	12.8	7.50	12
Ensilage cutter	325	15	2.0	39.88	12.3	5.70	7
Manure spreader	160	16	1.5	20.12	12.6	.80	25

How Costs Are Figured

The values given in this table for average estimated life (2), repairs as per cent of cost new (3), and days used per year (7) are averages taken from actual farm surveys.

The total annual cost of machine use (4) includes depreciation, interest, and housing. These items have been included in the total annual cost (4) although they are not shown in the table. The method used in computing these special items was the same as shown for grain drill.

Remember that the cost per day (6) depends greatly on number of days machine is used per year.

Fertilizing for Permanent Hay

Condensed from Better Crops With Plant Food

A. R. Midgley and D. E. Dunklee

Agricultural Experiment Station, Burlington, Vermont

ON most dairy farms chemical fertilizers and manure are primarily used on the corn crop. Furthermore, the fertilizer is usually placed so close to the corn plants that they get most of this added fertility. Under such circumstances oats, clover, and timothy which follow in rotation receive only the plant food left by the corn.

Ordinarily this fertility lasts only two or three years. The yield and quality of hay rapidly decline thereafter in spite of occasional top-dressings of manure, and finally ebb so low that the farmer is compelled to plow again and repeat the same rotation. Such a scheme is apt to be characterized by several years of hay hardly worth cutting and leads to the prevailing thought that a field of run-off grassland needs "the plow."

Formerly, it seemed that the farmers were correct, that the only sure-fire method of attaining better hay was plowing and rotating more often, growing more corn, and fertilizing it more heavily. Now, however, good permanent hay on many fields seems to be a better way.

There are many good reasons why permanent hay is an advantage over the present method of hay production and why it has a place on many farms. First, there are often serious obstacles to plowing, especially on many New England farms. To plow heavy clay soils in the spring is almost impossible because the plow gathers wet clay like a snowball. This puddles, the soil forms hard clods, and makes a poor seedbeed. Also, in the summer, the clay dries out and toughens up brick-hard, making plowing impossible. Fall is about the only time when the moisture is just right to leave the seedbed in good condition. Fall plowing, however, has the disadvantage of leaving the soil bare and unprotected during the winter.

Plowing on upland hay farms is likewise a drudgery, hampered by hidden stones and blocked by boulders and rock piles that restrict the length of furrows. Even where rocks do not trouble, the fields are often too steep or too wet, most of the year, to be readily plowed. Elimination of such tough and expensive plowing would provide a considerable

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saving with which to buy plant food.

Furthermore, it would be an advantage to reduce corn acreage on heavy clay soils, since at best the crop never grows too well and sometimes almost fails. Corn, too, is not very well adapted to wet land nor to localities bordering Canada which have too short a growing season. In such areas where hay is desired and where land is usually plowed up and seeded back down to hay as soon as possible, permanent hay is a logical goal.

Another good reason for maintaining permanent hay is to avoid erosion. In fact, a good sod is nature's best protection. Plowing soils in the fall, especially clay soils, exposes them to erosion during the winter even though the slope may not be very steep. Once permanent hay has been established, pelting summer showers will find no steep cultivated fields of corn to beat upon and wash away soil. A hay sod intercepts the raindrops and filters them off harmlessly. For erosion control, permanent sodded waterways are also recommended and highly desirable. Under all such conditions permanent hay is not only desirable but essential if the soils are to be left in good condition for generations to come.

Permanent hay is also desirable because it is a soil-building process. Some of the very best soils in the country, those in the Midwest, were built up by continuous grass over a period of centuries. Grass builds up organic matter, while frequent plowing and cultivation destroy it through oxidation.

The writers do not propose the elimination of corn from fields where it is well adapted, because in some years of short hay crops, 1941 for example, corn may be a lifesaver. It can provide large quantities of feed when hay fails. The idea is mainly to eliminate it from those acres with serious obstacles to growing it. Nearly every farmer has some land that is primarily adapted for hay purposes.

Five years ago experiments were initiated at the Vermont Agricultural Experiment Station to find out if commercial fertilizers would prolong the productive life of hay for a year or two, and perhaps even longer. Five hay fields on scattered farms representing clay, loam, and sandy soils were selected for test plots. Some were producing good timothy hay at that time, while others were more or less worn and beyond the likelihood of again being made productive without plowing and reseeding. On each field, fertilizer applications were broadcast evenly over the sod each succeeding year. To determine the relative merits of fall vs. spring use of fertilizers,

one series of plots was fertilized in the early spring, about April 15 to May 1, and an adjacent series in the late fall, about November 1 to 10.

Very simple fertilizer treatments were made on each field, comparing nitrogen alone in the form of cyanamid at 300 pounds per acre with a complete fertilizer containing its nitrogen as cyanamid at the above rate and superphosphate and potash to make a 1-1-1 ratio of plant food. In simple terms, the complete fertilizer was approximately equal to 600 pounds per acre of a 10-10-10 fertilizer. Untreated check plots in duplicate were maintained for comparison.

Yields for two cuttings of hay were obtained each year and observations recorded. Since trends were found much the same on all fields, the average data for the five experiments will be presented here for sake of simplicity.

Results Outstanding

Results obtained from the use of the complete fertilizer (Table 1) much exceeded expectations. It gave outstanding increases in the yields of hay the first year of application and progressive increases throughout the 4-year period of the experiment. Year by year the appearance of the stand also continued to improve until an average of more than 1½ tons of extra hay per acre per year was being obtained on all fields over and above the untreated check plots (Figs. 1 and 2).

Not only did timothy stool and make a marked comeback with the complete fertilizer; but clovers, including red, alsike, and white, also volunteered. In fact, the stands looked so good that farmers seeing them wished to try the treatment on their own fields. They would not want to plow under such a good looking and prolific stand of hay. It appeared that the hay could be maintained permanently without plowing and reseeding by means of a complete fertilizer at the rates employed. The complete fertilizer performed well on all five fields whether the soil was clay, loam, or sand. From these experiments it was very evident that a sufficiency of plant food would maintain hay in a permanent productive condition, and that the reason why hay stands "run out" is because they exhaust the available plant food.

However outstanding the result from its use, it still seemed possible from the appearance of certain of the plots that the complete fertilizer was not used in the most economical rate or in the most economical ratio on each particular soil. Therefore, experiments have been recently established to determine the best fertilizer rates and ratios for permanent hay on different soils, but sufficient time

Table I—The Effect of Nitrogen Alone vs. Complete Fertilizer on Yields of Hay from Five Fields

	Average increase over check, dry weight basis (lbs.)				
	1937	1938	1939	1940	Total
Nitrogen alone	711	1,059	1,010	1,158	3,938
Complete fertilizer	2,075	2,394	2,963	3,448	10,880

has not elapsed to obtain these data.

Farmers often have time to apply fertilizer in the fall, whereas they are apt to be rushed in the spring. If complete fertilizer were just as effective when applied in the fall as in the spring, the former would be a good time to apply it. Therefore, early spring (April 15 to May 1) and late fall (November 1 to 10) applications of complete fertilizers were compared to see if they were equally effective for the growth of hay. Here again resulting trends in yields for the five fields, with one exception, were much alike.

Average data are shown in Table 2. Over the 4-year period the early spring application of complete fertilizer was better than a late fall application of the same fertilizer. Observations also confirmed these data.

Although the difference was not great the first year, it was noticeable thereafter. The fall application of complete fertilizer was inferior probably because its nitrogen leached or washed away and thus became partly ineffective during the winter. Cal-Nitro (nitrate), a more easily leached form of nitrogen than cyanamid, was also included among the fertilizers used as a possible check on the validity of such an idea. If fall applications of cyanamid-containing fertilizers were inferior to spring applications by reason of leaching, Cal-Nitro fertilizer should be still more inferior because of greater leaching. Results obtained in this connection are shown in Table 3.

Both cyanamid and Cal-Nitro yielded much less when used in late fall than in early spring, Cal-Nitro particularly so. This indicated that leaching and washoff of nitrogen did occur and were probably the cause of the inferior effect of fall applications. Although fertilizer is not supposed to move laterally very much, vegetation on some plots indicated that fertilizer applied on rolling land in the late fall had moved several feet out of bounds. Washoff of fertilizer applied in the late fall may be more of a factor than is usually considered, especially if the surface soil freezes before the fertilizer leaches into it. It now seems possible that the fall application was

Table II—Early Spring vs. Late Fall Application of Complete Fertilizers on the Yields of Hay from Five Fields

	Average increase over untreated check, dry weight basis (lbs.)				
	1937	1938	1939	1940	Total
Early spring application	2,075	2,394	2,963	3,448	10,880
Late fall application	2,049	1,885	2,355	3,067	9,356

made later than it should have been for most efficient use, but previous to the experiment it had been recommended that the fall application should be made after active plant growth ceased.

In general, under Vermont conditions it may be concluded that an early spring application of ready-mixed commercial fertilizers on hayland will give better results than a late fall application. It is not known what the effect of the fertilizer might have been had it been applied on the sod at other times during the growing season.

If ingredients of a complete fertilizer are purchased and applied separately, the nitrogen should be applied in the spring. It would seem that super-phosphate and potash might be applied either in the fall or spring although no experiments have been conducted to show this. While extra penetration from fall fertilizer application may appear desirable, extra contact and consequent soil fixation of plant food in unavailable form probably offset this advantage.

At the outset of these experiments it was thought that nitrogen alone on ordinary grass hayfields would be sufficient to prolong the productive life of hay for a year or two. However, the results obtained on all five fields indicated that nitrogen alone would not suffice. Fertility being at the customary farm level, nitrogen at a liberal rate of application increased the hay yield less than 900 pounds the first year, and not over 1,200 pounds thereafter, without visibly improving quality. At 1939 prices, this increase in yield from nitrogen alone was obtained at a fertilizer cost of about $14 per ton of hay, which is considerably more than one can afford.

Nitrogen alone gave little trend toward improvement in yield, whereas complete fertilizer gave a marked trend. With nitrogen alone grasses, like timothy, blue, and orchard, were stimulated only to a small extent; and new hay species were absent. This was in marked contrast to the accomplishments of the complete fertilizer which stimulated and propagated clovers and hay grasses.

On hayfields in the usual state of fertility, phosphates and pot-

ash are so badly needed that nitrogen alone could not be recommended even for one year. Only where phosphate and potash have been recently and generously applied could the use of nitrogen alone on hay be justified. At 1939 prices for the complete fertilizer used on all farms, the hay was produced at an average fertilizer cost of less than $7 per ton of hay. Under ordinary circumstances this complete fertilizer would pay if the hay was needed and had to be bought. Furthermore, there is undoubtedly considerable residual fertility not yet used by the plants. It is very likely that the fertilizer cost per ton of hay can be reduced without impairing quality when results of present research work on fertilizer rates and ratios are available.

For maintaining permanent hay, manure is a valuable plant food deserving more attention than it often receives and special attention this year when fertilizer supplies, especially nitrogen, are short. One ton of ordinary farm manure is equal to approximately 100 pounds of 10-5-10 commercial fertilizer. In practice such value is seldom attained because an appreciable fraction of the nitrogen in the manure is lost into the air as ammonia before it can be used by plants. This is especially true of manure top-dressed on hayland where it is subject to drying and freezing, which expel the ammonia. Furthermore, on the phosphate-hungry soils prevalent in this region, manure is much poorer in phosphate than it should be for maintaining permanent hay.

Several practical ways have been found to increase the crop-producing value of manure. Each has a place in the fertilization of permanent hay.

Single strength 20% superphosphate at the rate of two pounds per cow per day or its equivalent can be spread evenly in the clean barn gutter to strengthen the "weak phosphate link" in manure and save some ammonia that would otherwise escape into the air in storage and in handling. Also, in this way the value (availability) of the superphosphate has been markedly increased on a number of soils. No fertilizer chemical has been found that can save all of the ammonia in manure. Superphosphate is as

Table III—Late Fall vs. Early Spring Application of Cyanamid and Cal-Nitro upon Hay Yields, Average of All Data

	Yields per acre, dry weight basis (lbs.)		
	Fall application	Spring application	Difference in favor of spring
Cyanamid nitrogen	1,318	2,027	709
Cal-Nitro nitrogen	1,099	2,367	1,268

effective as any known at present.

On the same weight basis, 20% superphosphate is more effective than triple strength in retaining ammonia because of the gypsum, which the former contains and the latter does not. It has been found that gypsum, together with phosphates, has power to react with and retain some ammonia under conditions prevailing in manure.

Either granular or pulverized forms may be used on hay by way of the gutter. The choice depends on individual preference. Pulverized, coming in better contact with manure, retains more ammonia than granular, but this advantage may be practically offset because the pulverized is more slippery under the cow's feet.

While superphosphate added on the loaded manure spreader will distribute the phosphate evenly on hayland, it lacks the advantage of conserving ammonia because it doesn't come in contact with the freshly voided urine which readily ammonifies and from which ammonia so readily escapes. Recent experiments have well proven the merit of phosphated manure on hayland.

Muriate of potash on the top of the loaded manure spreader is another way to improve permanent hay. There are a number of soils, especially sands and loams, in this region that need extra potash in addition to manure to produce good hay. Experiments indicate that the potash has no beneficial or detrimental effect upon the nitrogenous part of manure, but since the manure is moist it absorbs and holds the potash. In this way potash is protected against excessive fixation because only part of the potash becomes intimately mixed with the soil. This is especially true on some soils that are known to fix rather large amounts of potash. There is no harm in using potash in barn gutters provided the liquid manure is carefully conserved, but perhaps the most practical way is to use it on top of the loaded spreader. It has been found just as effective on the spreader where the manure has previously been phosphated.

Means of Liming

Hydrated or burned agricultural lime spread evenly in the clean gutter (two pounds per cow per day is a means of liming hayland. It also preserves some nitrogen which would otherwise escape into the air as ammonia, (Vt. Sta. Bul. 456). Its beneficial action depends on making the urine so alkaline that ammonifying bacteria and enzymes are prevented from converting urea to ammonia. Hydrated lime eventually carbonates and finally loses its main preservative action. The length of time depends upon the temperature — the cooler the

longer the period of active preservation. The manure should be applied to the land before the lime completely carbonates if nitrogen is to be preserved for plants in this fashion.

Probably such use of caustic lime with manure seems contrary to all established rules and teachings to the effect that lime on manure would drive off valuable ammonia. It is recognized that if ammonia is present, caustic lime will drive it off. Nevertheless, all good rules have exceptions, and a valuable one now discovered is, in brief: Caustic lime used in the clean gutter can not drive off ammonia because it is present before ammonia is formed, and because its strong alkalinity blocks ammonia formation.

Most of the urine naturally goes to the bottom of the gutter where it comes in direct contact with the very alkaline lime, but the urine not in contact with the lime begins to ammonify. When the manure is shoveled from the gutter, the limed bottom portion becomes partly mixed with the upper part and some ammonia is immediately released. However, in spite of this slight immediate loss, the treated manure ultimately loses less nitrogen (from subsequent drying or freezing) when it is spread on the land. Barn trials conducted bear out this statement.

For the improvement of hayland it is recommended that caustic lime and superphosphate be used in the gutter one at a time, otherwise their chemical actions would nullify each other. When the yearly allowance of superphosphate is thus used up, change to caustic lime. One can thus separately phosphate and lime his land by way of the gutter.

Ground limestone seems to have no beneficial or detrimental effect on manure because both are about the same degree of alkalinity. Farmers who do not have lime spreaders may add ground limestone (not caustic lime) on top of the loaded manure spreader and thus spread it this way. Ground limestone may also be applied in this way on phosphated manure with no detrimental effect either to the availability of the phosphate or the manurial nitrogen. This, therefore, permits two effective ways in which lime for permanent hay can be applied by way of the manure spreader.

The prime objective in maintaining permanent hay is an abundance of well-balanced plant food. This can be attained either with complete fertilizers and lime, or with manure improved with superphosphate, potash and lime. Furthermore, such permanent hay is a better food for animals by reason of the extra minerals it contains is indirectly a guarantee of better human nutrition.

Heavier Grain Feeding Best Way to Increase Milk Flow

Condensed from The Western Farm Life

EVERY farmer is now aware that the United States needs more milk to help win victory. Some have already stepped up their production to meet the demand, not by adding new units to the herd but by changing their practices.

There are several ways farmers can go about producing their share of the necessary additional milk. Some of the milk now being fed to livestock can be reserved for human consumption, or more milk can be put in the pail by improving the quality of roughage and pastures. Cows that would normally be culled can be retained in the herd. But larger production can best be realized by heavier feeding of grain balanced with sufficient protein.

How much more milk will be produced by heavier feeding, and how much more grain it will pay to feed have been determined by the United States department of agriculture in tests conducted in cooperation with 10 state experiment stations. It was found that each additional 100 pounds of grain fed produced additional milk, but not quite so much more as the 100 pounds before it. On an average, the increase in production was about 100 pounds of milk for an extra 100 pounds of grain, but it ranged from 150 pounds more milk at the lightest rates of feeding grain down to 60 pounds more milk at the heaviest rates of feeding.

From the results of these experiments were constructed the tables on the next page. Although they are self- explanatory, a few questions might arise in their use. If a farmer is feeding more roughage than the table mentions, he can make a rough adjustment by figuring that 1½ pounds of hay is just about equal to 1 pound of grain in feed value and that 2½ pounds of silage are equal to 1 pound of hay. For cows on pasture the grain figures in table 1 may not hold good during the first month or two when the pasture is at its best. However, they should be reasonably accurate the rest of the year.

It is important to note that daily rates of feeding in table 1 are all based on annual averages. Actually a cow may not be able to eat enough grain to keep up the average early in the lactation period when she is producing abundantly. When production slumps off late in the season it

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may be advisable to feed her more than is indicated. One thing is certain. Farmers can best serve themselves and their country by feeding their dairy cows the very last pound of grain on which they can still make a profit.

How to Meet Your Milk Goal by Feeding More Grain

Approximate per cent increase in milk production wanted Per Cent	Per cent more grain necessary to feed to meet goal, if grain is being fed according to the amount of milk produced, at one of the following rates:			
	1 pound of grain for each 4 pounds of milk produced Per Cent Inc.	1 pound of grain for each 3½ pounds of milk produced Per Cent Inc.	1 pound of grain for each 3 pounds of milk produced Per Cent Inc.	1 pound of grain for each 2½ pounds of milk produced Per Cent Inc.
5	11	11	12	14
10	23	23	26	31
15	35	36	41	..
20	48	51	59	..
25	62	67	80	..
30	78	84	..	..

This table is based on milk containing 4 per cent butterfat, and on grain fed in addition to 2 pounds of ordinary hay daily per 1,000-pound cow.

Suggested Quantities of Grain to Be Fed Per Cow Daily under Varying Prices

Section A—Daily Production of Milk, Testing			
3½ % fat	4 % fat	4½ % fat	5 % fat
11	10	9	8
17	15	14	12
22	20	18	16
28	25	23	21
33	30	27	25
39	35	32	29
45	40	36	33
50	45	41	37
56	50	45	41
61	55	50	45
67	60	54	49

Directions for Using Table—(1) Divide the local price of 100 pounds of grain by the price at the farm of 100 pounds of milk. (2) Locate the column in section A nearest the percentage of butterfat in your cow's milk. (3) Follow that column down the page to the figure nearest the number of pounds milk each cow is producing daily. (4) Follow that same line below to the column in section B that comes nearest to representing the local relationship between grain prices and milk prices. (5) There will be found the number of pounds of grain you will need to feed daily per cow to get the greatest total return for your milk over the value of the grain fed.

Section B—Quantity of Grain to Be Fed When Grain Price Is

1½ times milk price	1¼ times milk price	Same price as milk	¾ of milk price	½ of milk price
2	2	2	3	4
4	4	5	6	7
6	6	7	8	10
8	8	9	11	13
10	11	12	13	16
12	13	14	16	19
14	15	16	19	22
16	17	19	21	25
18	19	21	24	..
20	21	23	..	..
21	23	..	..	..

The suggested number of pounds grain to be fed is in addition to 1.8 pounds of good hay per 100 pounds of cow daily (18 pounds for a 1,000-pound cow), or its equivalent in other roughage. This is equal to 2 pounds of ordinary hay per 100 pounds of liveweight (20 pounds for a 1,000-pound cow).

Pasture-Grown Porkers

Most swine feeders figure it takes about 4 pounds of grain to make a pound of pork, and experiment station trials approximate that figure. Ben Puterbaugh, Darke county, Ohio, proved that maximum use of pasture in a deferred finish plan can cut that to 1.74 pounds of grain for each pound of gain.

He bought 480 shotes May 1 that averaged 100 pounds apiece, and turned them on 42 acres of alfalfa and red clover pasture. There, during the next 70 days, they ate but 2.33 bushels of corn apiece and gained 75 pounds. That meant 36,000 pounds of pork on 62,720 pounds of grain. Ordinarily, it would require 144,000 pounds for that gain, so the pasture saved 81,280 pounds of corn, or 1,451 bushels. That meant each acre of pasture had produced in 70 days as much pork as 34 bushels of corn. But that is not all. It also had supplied the protein required to make 36,000 pounds of pork. That would amount to at least $8 an acre more.

The hogs had big frames and heavy middles when they were taken off pasture July 10. They went on grain and a 40 per cent protein supplement and were marketed about 45 days later at an average weight of 260 pounds. Puterbaugh timed the finish right, and hit the high day of the late summer market.

—*Capper's Farmer*

Cutting Labor Corners

Condensed from Farm Science Reporter

C. H. Van Vlack and J. B. Davidson

PRODUCE more in 1942 than ever before and do it with less labor and a reduced supply of equipment.

That, in brief, is the challenge thrown out to farmers as their contribution to the Nation's war effort.

Increased production with reduced labor can be had only by increasing the length of working hours or by increasing the efficiency of labor, power and machinery.

It will be difficult for any farmer practicing diversified agriculture to increase appreciably the number of hours he works. The alternative then, is to consider greater economies in the use of power and machinery.

About 60 percent of the cost of production is attributed to labor, power and equipment even in normal times. But the number of hours of man labor and horsepower required to produce a crop varies widely on farms. Much of this variation is the result of difference in topography, though some variation is the result of the combination of labor, power and machinery the farmer uses.

To make man labor go farther in field work often requires using larger equipment, or combining two or more implements and pulling them with increased horse or tractor power. The man on the small farm, especially, may find it to his advantage to cooperate with neighbors in purchasing larger equipment and in doubling up on teams to operate it.

Furthermore, farmers who own the larger implements may do the work for several neighbors as well as their own to the advantage of all.

Farmers with general-purpose type tractors use considerably fewer total hours of man labor for growing an acre of corn than other farmers with standard tractors or those who use horses. This was shown in a survey made in Iowa by John A. Hopkins, Jr., of the Iowa Station. The man hours used with a general purpose two-plow tractor were 4.9 hours per acre; 7.4 hours for two-plow standard tractor farms; 6.1 hours for three-plow standard tractor farms and 9.3 hours for horse farms.

The difficulty with the standard tractor is that it is economically impractical for the row-crop grower, since it necessitates keeping enough horses to plant and cultivate the crop. The general-purpose tractor, on the

Reprinted by permission from the Iowa Farm Science Reporter, Ames, Iowa, April, 1942

other hand, is very efficient in the use of man labor. Only about half as many man hours are required with the general-purpose tractor as with horses.

An analysis of the records of members of the Iowa farm business associations showed that farmers with different types of equipment varied from 6 to 15 minutes per bushel to grow and harvest each bushel of corn.

C. K. Shedd, E. V. Collins and J. B. Davidson of the Iowa Station in an experiment in 1939 under favorable conditions, with corn yielding 85.8 bushels to the acre, grew and harvested the corn with an expenditure of 2.7 minutes to the bushel, or about half that of the lowest figure in the farm business associations. That record can be duplicated by farmers under favorable conditions using similar equipment.

Here is what the investigations we have carried on at the Iowa Station, in cooperation with the Bureau of Agricultural Chemistry and Engineering of the United States Department of Agriculture, have shown:

1. A tandem-disk harrow is more effective than a single-disk harrow in filling up tractor wheel tracks and leveling off other irregularities in the soil surface.

2. One tillage of plowed ground with a tandem-disk harrow and spike-tooth harrow just before planting is generally sufficient preparation of the seedbed. Additional tillage—such as disking the ground at various times before the final seedbed preparation—did not improve the weed control, stand or yield of the corn.

3. One tillage with a single-disk harrow or with a field cultivator is not sufficient seedbed preparation.

4. For lighter operations and final preparation of the seedbed, the spike-tooth harrow is preferable to other machines, except for spring plowing when a rotary hoe section is attached to the plow.

5. Early cultivation with a spike-tooth harrow, spring-tooth weeder or rotary hoe is effective in killing small weeds when the soil has been lightly crusted by a moderate rainfall. Labor and power requirements in using these machines are low.

6. Early cultivation with a sweep cultivator after the corn is large enough for thorough covering of the weeds in the corn row will destroy practically all weeds.

7. Early cultivation was omitted in an experiment through a 6-year period without causing any reduction in yield except in one year when wet weather prevented later cultivation at the proper time.

8. Sweeps do a better job of cultivating than shovels. Disk hillers are the most effective equipment for covering weeds in the corn row.

9. An experimental spring-tooth weeder rear attachment for a tractor cultivator effectively finished the kill of weeds and leveled the soil between corn rows.

10. Good control of weeds can be had in drill-planted corn without any excessive ridging of rows by using sweeps, disk hillers and a spring-tooth weeder rear attachment.

11. It takes less labor and power with the lister method of culture, but yields are not so good as with the surface-planter method in central Iowa.

Practically speaking, the only reason for cultivating corn is to kill weeds. If there are no weeds, then there is no need of cultivating. The theory once generally accepted that it is necessary to maintain a good dust mulch on the surface in order to prevent the loss of moisture has been thoroughly disproved.

Most farmers do not cultivate corn too much, but some are expending more labor on corn cultivation than the results obtained justify. Seldom is there any reason for cultivating more than three times.

Iowa farmers generally are convinced that shallow cultivation is better than deep cultivation for corn. Some farmers, however, are reducing yields, at the cost of more power, by cultivating too deeply.

Soybean cultivation competes for time with corn cultivation. Those who are growing soybeans can hold down labor in cultivating the beans by preparing a good seedbed, as one would prepare it for corn, harrowing it just before the beans are planted. The ground may then be harrowed again just before the beans are up, when they are about 3 inches high and again when about 6 inches high. The use of the harrow will enable covering much more ground in a given amount of time, thus greatly reducing the man labor needed for soybean cultivation.

It's a temptation to speed up in cultivating corn with the row-crop tractors, but tests carried on at the Agricultural Engineering Farm of Iowa State College show that at 5 to 6 miles per hour, the job of killing weeds is likely to be poorer than at a slower speed.

In the tests made by the agricultural engineers, they found that a speed of about 2½ to 4 miles per hour was approximately best from the standpoint of doing a good job of cultivation.

It is true that the cultivator can be adjusted to do a fairly good job of getting the weeds at the high speeds, but it is necessary to slow down in turning at the ends and there the fields are apt to be weedy if high speeds are used.

Profitable Air-Conditioning

Condensed from American Poultry Journal

J. Francis Cooper

AREN'T those rather large fryers?" I asked Clare S. Brush as he showed me through his air-conditioned poultry plant at Wall Springs, Fla.—one of the first air-conditioned poultry plants in the country operated on a farm basis.

"Man," he said without hesitation, "we *broiled* one of those 3-lb. fryers Sunday for dinner, and you could take the leg and bite a mouthful out of it, without having to string it off as you usually do with a chicken leg."

Evidently his customers also find air-conditioned fryers to be tender, because he has had to expand his operations from 500 to 600 chicks up to 1,200 a week, and even then he is not able to fill the demand for birds from Harbor Lights Farm. He believes that air-conditioning helps to grow them off fast and tender, and he knows that his feed bills are smaller and that the birds are uniform in size.

Mr. Brush is a former designing engineer turned poultryman. Mr. Brush could get along all right in winter, but trouble laid a heavy hand on him in the summer. He lost birds and he lost money. Finally, in the summer of 1940, he lost about 7,000 chicks at one time, and he was licked so far as raising poultry by conventional methods was concerned.

About this time, he had an attractive offer to go with a battery manufacturer and get back in to his old profession of designing.

While he was wavering in his decision, he happened to read about the big demonstration Grunow plant in Wisconsin. "Why hadn't I thought of air-conditioning before?" he pondered, and decided to try to establish a plant.

Too broke to install it with his own capital, he tried without success to raise money, until finally he was visited by an acquaintance who agreed to loan him the money. He went to an air-conditioning firm, but they didn't know what was required to keep chickens at an even temperature. After pondering the matter with him, they decided that a 5-ton unit would be needed to condition his 40x85 ft. house that had four wall thicknesses and was well insulated. (A 5-ton unit is one that furnishes the same amount of cooling as would the melting of 5 tons of ice in 24 hours.) The power company guessed that his

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electric bill would be $80 a month, which has proven pretty close to actual costs.

The house, air-conditioning plant, and batteries cost $12,300. Brush began 4 starting batteries in the brooder room, with a capacity of 2,400 baby chicks. Both batteries and capacity are now double. In the growing room he began with 8 batteries with a capacity of 4,800 chickens, and that, too, is now double. With air-conditioning, he can keep a full 600 growing chickens in each battery through the year, where he would have to fill them only about half full in the summer time without air-conditioning.

His plant also has a 10 x 15 ft. dressing room, which he may use some day when the market gives him a chance to sell a few fryers at home. He has scrubbing and cleaning equipment, and he soaks his feed troughs over night in chlorine water.

Mr. Brush planned to raise 600 chickens a week, and a neighbor was going to install a similar plant and raise another 600. But the neighbor has been unable to carry through his plans, and Mr. Brush has expanded his plant to supply the entire 1,200. For this number, he has replaced his 5-ton unit with one twice that size.

He has found that summer-hatched chicks don't grow off quite so well, as earlier chicks. An accurate, informative record card accompanies each battery. Records are kept daily, and when anything happens, Mr. Brush is quite apt to know what, when, and why. His records tell him the story.

The young chicks are kept in a brooding room, made by partitioning one end of the building, for the first three weeks, and the temperature in that room is maintained constantly at 75 degrees. Then they are placed in the growing room, where the temperature is 72 in winter. Last summer he let it rise to 82. The air is changed throughout the house every 20 minutes. He has an auxiliary heater, as yet unused, for the brooder room.

When they go to the growing room, he separates out the biggest cockerels and puts them in the top shelf of the battery, the biggest pullets being placed in the bottom shelf. Then the middle-sized ones are right where he can see them as he goes by, and he can keep them growing. He feeds a broiler mash three times a day —morning, afternoon, and midnight. About every two hours through day and part of the night, he makes a round of the batteries, stirring the mash with a small paddle and encouraging the chickens to eat more.

Fluorescent lights burn all night, and the birds never see darkness from the time they enter the plant until they leave for

market. They are active and eating most of the time.

If a weak chick shows up in his batteries, he unceremoniously throws it out. "It doesn't pay to take chances with the weak ones," he opines. "I might get coccidiosis, colds, or some other trouble that would cause me a lot more loss than the one chick." But when the plant is working properly, he loses only about one in 200 from winter and spring hatchings. His losses from some lots of summer hatchings have been heavier, and he attributes them to weak chicks.

"My chicks in winter and spring at two weeks old are as big as the average at three weeks," he said. When they are 8½ weeks old, they weigh 3 lbs. except the summer ones; which grow more slowly, but he markets most of them at 2 to 2¼ lbs. His figures show that it takes about 4 lbs. of feed to produce a 2-lb. fryer in the air-conditioned building, as compared with 5 lbs. without air-conditioning. This gives him a saving of about 20% in feed.

His chicks don't have bare backs, either, being well feathered all over. When he carried a batch to his regular market in St. Petersburg recently, the Negroes whose duty it is to pick the chickens exclaimed, "Here comes some more of those good dressing chickens." Incidentally, one firm takes 900 fryers a week at 23c a pound the year round.

"With this system, my chicks are uniform in size, and I can deliver exactly what is ordered," he explained. "If my buyer wants 200 fryers weighing 2 lbs. each, when I deliver them he has not over 410 lbs. of fryers, and no individual varies from the 2-lb. weight by more than 2 ozs."

He has sold a number of pullets for layers and breeders, and has watched them carefully after they have left the air-conditioned plant. He has found that if they are taken off in the fifth week, just before they are 5 weeks old, they become adapted to their new surroundings without appreciably slowing up in growth. Taken off either younger or older, they are set back for about 2 weeks.

"What is it costing you, and how do your receipts compare with costs?" I asked, since anyone contemplating air-conditioning a poultry plant would want to know something about the financial end of the game.

The engineer-turned-poultryman was quite willing to help here, also, and forthwith gave me his figures, based on one week's operations. Of course, the chicks coming out each week have been in for 6 or 8 weeks, but instead of following one batch through the plant, we just took one week's total expenses.

First we figured on a basis of 600 chicks a week, and here are the debits: power, $20; chicks, $60; labor (boy after school), $5; feed, $75; delivery, $3; payment on building and equipment, $45; TOTAL, $208. Receipts, 600 chicks averaging 2 lbs., 1,200 lbs. at 23c, $276.

Now that Mr. Brush has his 10-ton unit installed and is putting 1,200 chicks a week through the mill, he figures his costs about as follows: power, $30; chicks, $120; feed, $160; labor, $15; delivery, $10; and payments, $45; total, $380. On the same basis of 23c a pound for fryers, his income is about $552 a week.

That's getting pretty good pay for his work, and allows him a good margin of safety for unexpected expenses, slight losses in the market, or other contingencies. And after the mortgage is paid off, he would be cashing in on another $45 a week.

"No, I can't say whether the air-conditioned fryer business is an absolute success, because I have been in it such a short time," says Mr. Brush cautiously. But just the same, he is enthusiastic about it, and I think he has good reason to be.

But before I left him, he added a word of caution as he told me of another man who was building a cheap, poorly insulated house, and expecting to carry a large number of chickens with a 5-ton unit conditioning system. "He's destined to have nothing but trouble," ventured Mr. Brush. "If you're going to air-condition, do it right."

Avoids Back Ridges

One of the worst drawbacks in disking and drilling at the same time, especially where a single disk drill is used, is the back-ridged condition in which it leaves the field. To overcome this I took the disks off the right side of the drill and put them on the left and those on the left were put on the right. This rig leaves the field nearly as level as if a tandem disk had been used.—*A. V. Lindberg*

—Capper's Farmer

Haying Circle

Seven dairy farmers near Hurleyville, New York, have formed a haying circle, similar to the old threshing ring. They have pledged 200 acres of hay harvesting to one man who has bought a windrow pick-up baler. These farmers will not have the worry of haying without help, at a time when other farm work is begging to be done.

—Farm Journal

Cover Crop Problems in Cultivated Orchards

Condensed from American Fruit Grower

Clarence E. Baker

Purdue University Agricultural Experiment Station

THE last decade has witnessed a general change in soil management practices in the apple orchard. Sods and mulches have come into much more common use and have almost entirely replaced cultivation in many apple producing sections.

From the standpoint of erosion control and the maintenance of a high level of fertility in bearing orchards, sods and mulches have demonstrated their superiority over a cultivation with cover crop system in many instances. Even young trees succeed under a sod or a mulch system if properly handled.

Some growers located on relatively level sites prefer to cultivate young apple trees and, in spite of the trend away from a cultivation and cover crop system of commercial orchard culture, there are still many acres of bearing trees grown under this system of management.

While following a program of cultivation with cover crop in many respects is proving to be a destructive practice on a long-time basis in the bearing orchard, it may have some advantageous possibilities in the young orchard where soil erosion is not a problem. Even in the bearing orchard certain details of management serve to minimize the destructive aspects of the practice so far as its effects on soil fertility and the physical structure of the soil are concerned.

In the case of a young orchard, a well conducted system of cultivation and the efficient use of cover crops makes it possible to incorporate an abundant supply of organic matter into the soil. The emphasis, however, should be on the cover crop rather than the cultivation. Many practices can be followed to advantage in the young orchard that are not possible later on. When the trees are young, cover crops may be grown as soil builders that will not succeed in the shaded conditions prevailing in bearing orchards. The area of soil on which the organic matter may be produced, likewise, is larger than when the tree must be allowed a greater feeding area. Deep rooted legumes, such as alfalfa and sweet clover, may be successfully used in young plantings, while

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the competition with the trees for subsoil moisture often makes their use in older orchards unwise. Deep rooted crops in the young orchard do much to improve the soil for later tree growth by adding organic matter to considerable depths through the growth and subsequent decay of their root systems. The openings that these decaying roots leave in soil strata that tend to be too compact or impermeable permit easier movement of soil water, better aeration and more efficient growth of tree roots.

Even though when properly inoculated legumes utilize nitrogen from the soil air, they are unusually heavy feeders of soil nitrogen which they use to build their high protein content during the time they are making active growth. This often results in an almost complete removal of the available nitrogen in the soil, which also is against their use in the bearing orchard. In the young orchard, the utilization of surplus nitrate nitrogen by the cover crops is an advantage if the crop is properly handled to prevent the loss of the nitrogen liberated in the soil. The nitrogen stored in the legume plants can largely be returned to the soil when the resulting organic matter decays.

In any cultivation and cover crop system, the soil should be clean cultivated as small a part of the time as possible. Cultivation stimulates bacterial action, and nitrate nitrogen is produced from proteins and other insoluble nitrogen compounds of the organic matter. As these nitrates are very soluble, they leach from the surface soil to lower areas with the movement of ground water and large amounts of nitrogen are lost. Experiments in New York showed that soil on which alfalfa was grown for two years and then permitted to lay uncropped for two years lost nitrogen at the rate of 450 pounds of nitrate of soda per acre per year. When the soil was cultivated but not cropped, the loss of nitrogen jumped to an equivalent of from 587 to 1835 pounds of nitrate of soda per year. Where, after two years of alfalfa, the land was replanted to alfalfa or to timothy, the loss of nitrogen was reduced to 1.8 and 1.6 pounds per year, respectively.

This points toward the efficiency of a double cover crop system in comparison with growing only one crop in a 12-month period. Perennial legumes, of course, occupy the soil during their period of culture. A summer crop of soybeans followed by a fall-sown crop of rye or winter wheat, or a rye and vetch combination fulfill the requirements nicely. As legumes tend to decay rapidly and release large amounts of nitrogen when plowed

or disked into the soil, they should be followed by a vigorous growing crop that can utilize a large amount of nitrogen.

Legumes contain a greater amount of nitrogen in relation to the amount of carbon in their composition than non-legumes. This is spoken of as the carbon-nitrogen ratio. Non-legumes are said to have a wide C/N ratio in comparison with legumes.

The large amount of cellulose or the high carbon content of non-legumes, such as nearly mature rye or wheat, often presents a different problem when these crops are incorporated with the soil. When large quantities of cellulose are plowed under, the development of micro-organisms which feed on this material is encouraged. These micro-organisms also require nitrogen and in order to secure it they must compete with crops or trees growing on the soil. This leads to a temporary shortage of nitrogen. Such a condition prevails for a time when straw is added as a mulch and also when the incorporation of rye or wheat cover crops in the spring is delayed until the plants become mature or woody. This sometimes happens when wet weather occurs in the spring and plowing or disking of overwintering cover crops must be delayed. This condition causes a shortage of nitrogen during the period of active growth of the trees when it is most needed. If a dry period follows, the nitrogen shortage is likely to be prolonged. In the case of normal rainfall, the decaying vegetation soon begins to release the nitrogen in a soluble form. To avoid this unfavorable condition, the overwintering cover crop should be disked or plowed under before it becomes too mature.

The aim in cover cropping the young orchard should be to build up as great a reserve of organic matter as possible for later use of the trees. In an orchard under observation in New York, where red clover was seeded every two years and the resulting crops plowed under during the early life of the orchard, a large reserve of organic matter was established. This reserve carried the trees at a high level of growth and production for many years under a series of different cultural systems, some of them none too favorable for tree growth.

What about cover crops in the bearing orchard? Can ordinary cover crop growth be counted upon to maintain the organic matter destroyed by cultivation over a long period of years? An experiment at Purdue University, now in its twenty-fifth year, gives us a partial answer to this question. The crops used included the winterkilling non-legumes, millet and buckwheat; the winterkilling legume, soybeans; a hardy non-

legume, rye; the hardy legumes, crimson clover and winter vetch, and a weed plot on which any weeds that volunteered were permitted to grow. These crops were sown in late July or early August each year following clean cultivation from early spring. One plot was seeded to rye in October after apple harvest.

Soil analyses for total nitrogen on these various plots at the beginning of the experiment and at the end of twenty-three years indicate that none of these cover crops has maintained the amount of nitrogen present in the soil at the beginning of the twenty-three year period. Some crops have permitted the loss of greater amounts of nitrogen than was lost from clean cultivated check plots on which no cover crop was grown. Millet, early seeded rye and vetch have been most effective in maintaining the organic matter, but even these have permitted the loss of approximately 20 per cent of the original nitrogen during the twenty-three year period. Soybeans and crimson clover were especially poor crops in the mature orchard because of the difficulty of securing a good stand or good growth under shady orchard conditions.

These figures are recorded not as applying to all orchards on all types of soils but as an example of what frequently happens over a long period. Too much faith undoubtedly has been placed in the ability of cover crops to maintain the organic matter under orchard conditions. In another Purdue experimental orchard, planted on a rather poor soil, one plot grown continuously under cultivation with a fall-sown rye or wheat cover crop became so unproductive after twelve years that the fruit produced had insufficient commercial value to justify harvesting it. Where nitrogen was added, more fruit was produced, but it was equally small and of even lower quality. It was impossible to grow a good cover crop after the orchard was about eight years old either with or without nitrogen. A plot of similar trees located immediately adjacent to the cultivated ones and grown from the third season after planting in blue grass sod to which nitrogen was applied, is producing abundant crops of large, high-quality fruit and the trees are much more vigorous and healthy than the cultivated ones.

Many cultivated orchards are falling off in growth and production more rapidly than is being realized. Any signs of declining growth and production should be taken as a warning that a change in soil management may soon be necessary.

Feeding Trials at Missouri Station

Corn Beats Other Silage

Condensed from Missouri Ruralist

A VERY interesting experiment was conducted at the Wisconsin College of Agriculture on wintering yearling steers on various kinds of silage. Atlas sorgo, legume and small-grain silage were tested, as well as corn silage made from hybrid corn. The legume silage was a mixture of alfalfa, sweet clover and red clover, which was grazed by sows and their spring litters, then cut the last week of May. Blackstrap molasses was added. The small-grain silage was a mixture of barley, oats and rape.

The hybrid-corn silage produced more rapid gains than any other silage fed, almost a half pound to the head daily more than its nearest rival. Corn silage was consumed in smallest amounts, too.

Next to corn, legume silage made the most rapid gains. About the same amounts of both legume and sorgo silage made 100 pounds of gain.

Altho the steers ate more small-grain silage than any other, the rate of gain was lowest and the amount of feed required to the unit of gain was highest. One ton of the hybrid-corn silage produced more gain than 2 tons of small-grain silage. And the steers on small-grain silage required 70 per cent more hay than those fed corn silage.

In one experiment lespedeza seed ground with a hammer mill was used in a fattening ration of corn, supplement, alfalfa hay and silage for yearling steers. The lespedeza seed was used in the place of soybean pellets. A lot of steers fed cottonseed cake the first winter and fed on the soybean pellets made the fastest and most-economical gains, but the lespedeza-seed ration was not far behind, and showed up better than a soybean-pellet ration fed steers that did not receive cottonseed cake the first winter. All 3 lots made economical gains, so that there are possibilities in lespedeza seed as a protein supplement. The seed was difficult to grind completely and it did not mix well with the corn. It was fed on silage, and considerable unground seed passed into the manure.

Adding cottonseed cake to a ration of corn silage and alfalfa hay increased the rate of gain and lowered the amount of silage and hay required to make 100 pounds of gain quite a bit.

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When these calves were continued on pasture in the summer, the largest gains were made by the steers which made the smallest winter gains. There were some wide differences in weight as the calves went on the pasture following the various kinds of winter rations, but by the end of the grazing period these differences were about erased. The steers fed the cottonseed cake in the winter gained the least in the summer yet were heavier at the end of the grazing season and appeared to carry slightly more flesh than the cattle in the other lots.

Hog feeding tests were made too, one on using various protein supplements. Some very complex mixtures were used, as was tankage alone. Results showed there was little difference in either rate of gain or economy of gain. In general the cost of a pound of protein was less in the simple than in the complex mixtures, so that even with the same amount of feed consumed for 100 pounds of gain, costs were lower when the simple mixtures were used. This was chiefly because corn was cheaper than the protein mixtures. For example, when a 23 per cent protein supplement was used only about 2 pounds of corn was fed with each pound of supplement, while with the 60 per cent supplement almost 10 pounds of corn was fed to the pound of supplement.

There were differences however, in how the supplement was fed. Lots of hogs allowed to choose between corn and supplement in a self-feeder ate more total feed and gained more rapidly than lots of hogs which had the corn and supplement already mixed in a self-feeder.

Bustle for Baler

To increase the efficiency of his pick-up baler, Herbert Lock, Carroll county, Missouri, has built a trailer that is pulled behind the baler. As the bales emerge from the machine they are placed on this trailer and then dumped in piles of about ten bales. This saves driving all over the field for bales.

The trailer was made from one that came with a terracing machine. Body of the trailer is just a little off center behind the baler, and the front end is held down by a catch. When the catch is released the trailer dumps bales behind.

—*Farm Journal*

Getting Those High-Priced Summer Eggs

Condensed from The Poultry Item

G. T. Klein

Extension Poultryman, Massachusetts

THE egg market, particularly in the East, is gradually changing. Peak prices are received a little earlier each year and poultrymen are changing their management plan to meet the new order of things. In Massachusetts we now expect our best egg prices in September and we hatch accordingly. Flock numbers are planned so they are at their height in July, August, September, October and November. This means hatching chicks in January and February and in the fall months. On *commercial farms, 25 to 40 per cent of the chicks are hatched out of season.*

To show just what has happened in the egg market, I have averaged the Boston wholesale prices from December to June and July to November for the five year period 1934 to 1938.

On nearby eggs, there is a difference of 12c per dozen in favor of eggs sold during the summer and fall and 8.5c per dozen on Western eggs. On nearby eggs the peak prices have been moved forward from the third week of November to the third week of September. The peak price on Western eggs is now in early November. Not so many years ago it was in December.

There are not more than 10 per cent of the hens on our farms in this state that are carried over into the second laying year. Most of these are on breeding farms where they have a special value for the production of chicks of high livability. As layers, hens produce only 70 per cent as many eggs as they do the pullet year. The pullet layers are pushed for eggs and marketed just as soon as they show signs of going out of production.

Breeding for a long period of production has received special consideration for several years and pullets hatched at the normal season of the year—March or April — will often give 15 months of continuous production. The poultry breeder calls it "per-

	December to June	July to November
Nearby Eggs	28.5c per dozen	40.5c per dozen
Fresh Western Eggs	26.9c per dozen	34.7c per dozen

Reprinted by permission from The Poultry Item, Sellersville, Penna., June-July, 1940

sistency" and while he cannot expect all birds in a family to average 15 months without a molt, he has many that will do so and he does pick families that lay not less than 300 days.

But, getting summer eggs is more than merely having hens that are bred for high production. Feeding, management and keeping hens comfortable are all necessary for good summer laying. It requires forcing methods and none should be spared, and, when a bird has served her time, to market she should go and a new pullet should take her place.

When hens are at the height of production, they will eat 30 to 35 pounds of feed a day for 100 birds, if they are heavy breeds. We watch this consumption and when it drops, we feed something to stimulate the appetite. It is an old story to recommend wet mash, but it is nevertheless, a feed we could hardly get along without. The consistency of it is varied from day to day for these little changes are to the liking of the hen. One day it is fed very wet, the next day dry and crumbly and then, in-between. The quick way of feeding wet mash is to pour water or milk on the top of the mash hopper once or twice a day, and it is an effective way.

Laying mash pellets can be fed just as effectively as a wet mash. There are few farms in all of New England where pellets are not a part of the ration sometime during the year. They can be used as a supplement to wet mash feeding and resorted to when additional stimulation is necessary to hold production. They can be fed in quantities varying from 3 to 6 pounds a day to 100 hens and at almost any time of the day.

The most palatable of all feeds for summer is condensed buttermilk. Even if it had no value other than its palatability and as a good source of protein, it is so superb in these respects that it would continue to be very extensively fed on commercial farms. It can be fed in the paste, mixed with a wet mash, diluted with water, or with grain soaked in it, and the results are just the same—it makes any feed more palatable.

Green feed is another stimulant for the appetite. If the flock has free range, perhaps the hens get enough of it. If the lot in which they run is bare and they have to go a quarter of a mile for green feed, then they should be handled just as a flock in confinement. The grass or green feed should be cut and carried in to them. There are many feeds that are palatable to chickens and the choice depends a lot on the one that grows best. Oats, clover, especially Ladino clover, rape, swiss chard and lawn clippings are some of the best. These

should not be fed in quantities that will interfere seriously with grain and mash consumption and a check should be kept on egg yolk color just to see that it does not get too dark.

I do not favor drastically cutting the grain consumption of birds during the summer months. The percentage of oats in the ration should be high as they will greatly help to control cannibalism. Our records at Massachusetts State College, where the cafeteria system has been used for years, and hens have a chance to eat mash, corn and oats according to their liking, show that during the summer, hens eat about 30 per cent mash, 40 per cent oats and 30 per cent corn. We have not fed wheat in large quantities because it is usually more expensive than other grains. Our experience with a well bred production flock certainly does not indicate that it is necessary to force hens to eat heavily of mash to the exclusion of grain in order to get summer eggs. It seems to be "total feed" rather than the definite proportions, that determines production.

The comfort of the flock is a very important consideration. A room in the basement of a barn is the most comfortable laying house that can be found on most farms. If the layers can be moved into such a room early in June it is not only easier to hold production but helps to prevent losses from heat. The value of insulated houses is fully appreciated in the summer but almost any building can be made more comfortable by opening up windows on the east, west and north.

Some extra or supplemental housing can often be built profitably on poultry farms. There are two types that are used rather extensively. There is the summer laying house, usually built 24 by 24 feet to house about 300 hens. It has nests, roosts and feeders and a rather low overhanging roof that offers ample protection from rain and weather. Hens are moved to this house in June and held until they molt. If the weather is cool when they are first moved out, burlap or boards are nailed on the sides for protection. This same arrangement is used again in the fall when protection is needed. In fact, some poultrymen enclose the shelter as tightly as possible and use it the year round, if added housing is needed.

Sometimes the summer houses are built with a concrete floor. This is highly satisfactory, for the houses are seldom moved. Hens may be allowed free range or they may be confined to a pen depending upon the location and conditions on the farm. If layers are moved before the first of July, egg production does not slump. It is usually so much more

comfortable in these houses than in the regular laying house that feed consumption actually increases soon after they are moved and egg production also increases.

Another type of house used to some extent for summer layers is a house popularly called the "Barracks House." This is usually a building about 24 feet in width that can be used either for brooding chicks or for layers. All equipment either for chicks or for the laying flock is removable. After the brooding season is well along and the pullets that were started in the house can be moved out to range, the laying house equipment is installed and hens are put in it to finish the year. This house, as well as other buildings mentioned above, open up the regular laying houses for early-hatched pullets that are ready for housing in July or August.

Housing the early pullets is viewed a little differently today. It was long a common rule that pullets must be housed by the time they reached 10 per cent production and a violation of this rule would cause a neck molt when they were housed. This has not worked out in practice for we frequently keep early-hatched pullets on the range until late in the fall and they lay 75 per cent during the summer. Perhaps due to more palatable rations and better production-bred birds, we can move them without a serious slump in production. On some of the farms, early pullets are purposely held on the range until fall and with good results. If green feed and shade are ample and the weather is extremely hot, production is higher and mortality lower than with housed pullets. Nests should be used on the range and a type similar in construction to the kind that will be used in the laying house.

In late summer, artificial lights are a valuable aid in holding production. It seldom pays to use them earlier than August 15 or September 1. After that time they will pay and will hold production in a good flock to a reasonable percentage. All-night lights and early morning lights seem to give about equal production, though we have a decided preference for all-night lights for a flock that is to be brought back into laying after a molt.

No program of feeding and management will hold a flock to 50 or 60% production without some culling. As layers go out of production and molt it is best to sell them for meat and to do so before they lose weight, as they can be expected to lose more than 1¼ pounds during the molting process as well as taking on a pin feathery condition which renders them almost unsalable for about 6 or 8 weeks.

Fertilizers Will Help Us Win!

Condensed from The Michigan Farmer

Dr. R. L. Cook

Assistant Professor of Soils, M. S. C.

MORE plant food is necessary for maximum production of many crops on many soils. Farmers must produce more this year than they have ever produced before. While more fertilizer could no doubt be efficiently applied in most localities, it is probably better to follow the advice, "Put your fertilizer to the best possible use." This means first of all, apply the correct analysis fertilizer for the particular soil and crop. Then apply the quantity which will give the most efficient yield increase, and use the method of application which experiments have shown to give best results.

There are certain crops in the rotation which should never be planted without fertilizer. Alfalfa and the clovers fall in this classification. This is in spite of the fact that they are soil building crops with respect to nitrogen and organic matter. They will not make their maximum growth unless the soil is well supplied with mineral plant nutrients. This is especially true of the nutrients phosphoric acid and potash. Where alfalfa and the clovers are seeded with small grain nurse crops the small grain must be fertilized if the alfalfa or clover is to be properly supplied with nutrients. On most heavy soils and sandy loams of high fertility, where the practice of seeding legumes with nurse crops is followed, oats and barley responded well to commercial fertilizer. This means then that 2 crops must be considered when the fertilizer analysis and rate of application are selected.

The results of several years of experimental work on the Reagh farm, Cass City, showed that it paid well to apply fertilizers for oats. An application of 200 pounds of 0-20-0 in 1930 increased the yield from 48.9 to 77.5 bushels per acre. The same fertilizer helped the red clover seeded with the oats sufficiently to cause an increase in yield in 1931 of almost a ton of dry hay per acre.

As an average of 4 years' results obtained in experiments on this same farm, unfertilized oats yielded 44.5 bushels per acre and those fertilized with 0-20-0 yielded 58.4 bushels, an increase in

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yield of 13.9 bushels. The plots which received 4-16-4 fertilizer yielded still higher, an average of 60.4 bushels per acre, 2 bushels more than was obtained as a result of the straight super-phosphate treatment.

On the Ferden farm in Saginaw County where the soil is Brookston silt loam unfertilized oats yielded, as an average for 7 years, 65.1 bushels per acre, while those fertilized with 4-16-4 at the rate of 150 pounds per acre yielded 70.0 bushels per acre.

Sugar beets, like alfalfa, should never be planted without fertilizer. Beets well supplied with plant food emerge quickly and grow rapidly right from the very start. The rapid early growth gives the plants a vigor which enables them to withstand the attacks of disease organisms and the effects of adverse weather conditions. It is not only essential that the correct analysis fertilizer be applied but that it be placed in the proper location with respect to the seed. The results of many experiments, conducted yearly since 1934, show that sugar beets make the fastest early growth and produce the greatest yields when the fertilizer is placed 1½ to 2 inches directly below the seed or at that depth and not more than one inch to the side of the seed. When the fertilizer is placed in direct contact with the seed, emergence may be delayed and germination injured (where the quantity applied is over 150 pounds per acre) and where the fertilizer is placed too far away from the seed the growth stimulation is delayed until the roots reach the fertilizer. The sugar beet tap root grows quickly downward but the small feeder roots extend in a lateral direction more slowly.

Unfertilized beets in 1937 yielded 6.6 tons per acre. Those which received 300 pounds of 2-12-6 in contact with the seed yielded 9.2 tons while those which received the same fertilizer in a band at the side yielded 10.1 tons, an increase in yield of 0.9 tons simply from the better location of the fertilizer.

There are drills now on the market and in use on many farms which place the fertilizer in this recommended position.

On fields where legumes have been recently grown and where stable manure has been applied in the rotation a fertilizer without nitrogen such as 0-14-6 or 0-20-10 should be applied at the rate of 300 to 400 pounds per acre. On other fields, not so well supplied with nitrogen, the same quantity of 2-16-8 fertilizer is recommended.

Sugar beets need a constant supply of boron. Unless a farmer knows for sure that he does not need boron in his beet fertilizer it is recommended that he buy

a fertilizer containing borax. The quantity of borax in the fertilizer should be so adjusted that he will apply 10 pounds per acre if application is made in side bands with the new type planter and a somewhat smaller quality if the application is made directly in contact with the seed. In other words, the farmer planning to apply 400 pounds of fertilizer with the new side band fertilizer attachment should buy a fertilizer containing 50 pounds of borax per ton. If he is using the old type machine which places the fertilizer directly with the seed and he plans to apply 150 pounds per acre he should buy a fertilizer containing 100 pounds of borax per ton, then be sure not to apply more than the 150 pounds. If this latter farmer drills some fertilizer before or after plowing he need not have borax included in the pre-planting mixture.

White beans are to be badly needed this year. Fertilizers, if properly applied, may appreciably increase yields of this crop. After 16 years of experimental work it was decided that it does not, as a rule, pay to fertilize beans unless the fertilizer can be applied in a band 1½ to 2 inches directly below the seed or at that depth and not more than one inch out from the seed. The experiments showed, however, that where the fertilizer was applied in this manner very consistent increases in yield were obtained. For instance, an application of 120 pounds of 0-20-10 has increased the yield, as an average over a period of 7 years, by 3.6 bushels per acre. In 1938, the year of maximum increase, the figure was 7.5 bushels increase in yield.

Considering all the experiments performed with this crop it seems advisable at present to recommend for the typical bean soils, such as heavy loams, silt loams, and clay loams, a fertilizer containing about one-half as much potash as phosphoric acid, .such as an 0-20-10. Apply at the rate of 200 pounds per acre and be sure to place the fertilizer in a band 1½ to 2 inches below the seed and not more than one inch to the side of the seed.

Judging from the results of experiments with corn, the benefits from fertilizers applied for corn in Michigan are often small. In the light of present conditions it may then be wise to use more fertilizer on small grains, sugar beets, and beans and less on corn during the present season.

In conclusion, it seems well to emphasize the point that the farmer should do everything in his power to increase production, even though the increased production may be rather costly. An extra ton of sugar beets will be worth while, even though it costs the farmer all the extra ton is

worth, in dollars and cents, because a ton of beets will make 300 to 350 pounds of much needed sugar. The value of that much sugar will not be stated in dollars and cents but rather in terms of the war-time requirements of 12 to 14 people.

The same line of reasoning may be applied to all farm commodities and fertilizers, intelligently applied, will play a leading role in the increased production necessary to win the war.

Small Grazing Areas Profitable

OF all the grazing stories written by the 1,655 head of cattle used in the 20-year grazing trials at the Northern Great Plains Field Station, Mandan, North Dakota, perhaps the most interesting is that of divided pastures.

Thru numerous tests it was found that, when continuously pastured, seven acres of grass was needed for a two-year-old steer. With this information a 70-acre pasture was divided into three pastures of equal size, the plan being to permit the grass on one of the plots to grow without grazing until it was fully mature (late July) for two successive years; then to let grass on the second plot do the same the next two years; and grass on the third plot go without grazing until it was mature for the last two years of the six-year period. This was done with the steers being rotated to keep them on pasture all season. The result: It took 14 steers to keep the grass on the 70 acres grazed down, while on a 70-acre check plot 10 steers were all that could be supported.

On the small pastures where 14 steers were grazed it was found that each animal walked one and five-eighths miles per day. On the large pasture the daily distance covered by each steer was three and one-sixth miles (more than twice that on the smaller pasture). Stock cattle on a 640-acre pasture were observed to have walked an average of five and one-twelfth miles a day. That less trampling of grass on the smaller pasture plots may help account for their larger carrying capacity is an observation made by the late Dr. J. H. Shepperd, President Emeritus of North Dakota.

Whatever the factors, it is definitely shown by the Mandan grazing trials that more steers can be carried per acre on small pasture areas on which preferred and rotation grazing are practiced than can be successfully pastured on large areas.—*I. M. Howard*

—*Successful Farming*

Reviving An Ancient Industry

Condensed from the New England Homestead

Allan Bratton

IN a wooded section of Connecticut, in the town of Union, an industry as ancient as history has gained a new foothold. There on extensive holdings of the Quinebaug Forestry Company, a column of smoke rises from three newly constructed charcoal kilns, which are daily turning out a product of great importance in peace time and of even greater importance in time of war. There, too, a contribution is being made to the conservation of one of our greatest natural resources, the forests.

Thirty-five years ago purchases of forest lands were made by the Wells brothers of the American Optical Company to supply the lumber needs of its business. The owners, with true Yankee foresight, as well as pride in good forest lands, planted many acres to forest trees and instituted protection from destructive forest fires, such as the erection of a fire tower overlooking some 15,000 acres of forest lands, company owned and equipped with short wave two-way radio for communication with the company's own forest patrol. This project also has the cooperative efforts of the United States Forestry Service.

There resulted a fine young forest fast coming into the production of trees of saw log size, when the hurricane of 1938 took such a severe toll of growing stock as to set back the forestry program many years. Although much lumber was salvaged from immature stands, much was left on the ground to rot and years of patient growth were destroyed. But despite the discouragement a new incentive to do something with what remained was created.

Less than a year ago a search for new markets for material not suitable for saw logs was started. The search led to the decision to attempt the manufacture of charcoal on a commercial scale. By December three kilns, each of 90 cords capacity, had been completed and production was begun. Such an ambitious start was further enhanced by the decision to produce the wood to be used for "coaling" under sound practices of good forest management. Today the business, though in its

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infancy, stands as an example of the possibility of combining sound business principles with those of forest conservation.

A few of the outstanding uses of charcoal are, domestic fuel, curing tobacco, annealing metals, manufacture of black powder and gas masks, filters for liquids and gases, pharmaceutical supplies, fuel for campers and steak grills.

If wood is heated in the presence of a limited supply of air, a distillation process takes place whereby water vapor and other volatile products are driven off as gas or smoke, charcoal remains as the end product. On the grounds of the Quinebaug Forestry Company, dome shaped brick kilns are used. They are filled with four foot sticks, the kind of wood and whether it is green or seasoned seems to make little difference. The charge of wood is ignited and then the skill of the operator is brought into play. He must know how to regulate a series of drafts located at the base of the kiln, so that the proper amount of air is allowed to enter, too little air might allow the fire to go out, too much might cause the charge to burn completely leaving only ashes. The strength and direction of the wind are the most important factors influencing draft regulation. From five to 10 days are required to burn a kiln depending on weather conditions, after which the kiln is cooled for about seven days. To open a kiln before completely cooled would result in the charcoal being burned up. The kilns are then unloaded and either placed in the familiar paper bags or delivered in bulk.

A well burned kiln will yield about 45 bushels of charcoal per cord of wood. The weight of the coal will depend upon the species of wood used as well as the amount of substances other than carbon contained in it. A good quality coal, such as is produced in the kilns described above, should have a bright lustrous appearance on the end when broken, have a distinct metallic ring when struck against a solid object and produce no smoke when burned.

Though all of the wood being used by the Quinebaug Forestry Company does not come from its own lands, all of the wood is produced under good forestry practices. Before cutting, trees of low quality, poor form or mature, are marked by a forester. Only enough material is removed from the land to make the operation economically possible and to improve the growing condition of the remaining trees. A continuous supply of material will thus be assured for permanent operation.

Figuring Your Farm's Beef Power

Condensed from Kansas Farmer

Roy Freeland

UP-TO-DATE cattlemen believe in rating farms for beef power, just as tractors are rated for horsepower. Not having enough cattle to utilize your rough feeds, they say, is worse than hitching a 2-bottom plow behind a tractor capable of pulling 3 or 4 bottoms. On the other hand, having more cattle than your farm can support to best advantage is like trying to pull a 3-bottom plow with a tractor built for pulling only 2.

Worst "fly in the ointment" for most farmers is that initial job of deciding how much the farm beef power is. If you buy a tractor, the horsepower already is rated, but if you buy a farm or start in the cattle business, it is left for you to do your own figuring on how much beef the place can produce most economically.

However, the job is made relatively easy by J. J. Moxley, successful cattleman and extension beef specialist for Kansas State College. Living and working with all types of cattlemen, he has gathered a wealth of practical beef knowledge direct from Kansas cow lots, and it offers safe guidance for the state's cattle raisers.

Mr. Moxley calls attention to the fact that beef production on most farms is limited primarily by man power and by the amount of feed and pasture that can be produced. He observes that the average "man output" of beef in Kansas is one carload a year. In other words, one man alone, on the average, can supply the labor for producing a carload of calves, or for putting a carload of gain on a lot of feeder cattle. The average cattleman with a grown son or a hired hand produces about 2 carloads of beef a year, while those with more help follow in about the same proportion.

Even more important than labor, in normal times, is the job of fitting your beef business to the acreages of pasture and feed crops which the farm can provide. As a basis for helping with the task, Mr. Moxley explains examples of farms which have a beef power of about one carload a year. A farmer producing his carload of beef in the form of feeder calves must have a herd of about 50 cows, and enough

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pasture and cropland to support them. The goal is a 400- to 500-pound feeder calf from each cow.

Since calves may be sold off the cows each fall, and cows may be carried almost entirely on pasture and rough feeds, this system requires little or no land for the production of grain crops. However, each cow will require the equivalent of about 3½ tons of silage and one-half ton of alfalfa during the year.

Knowing the productivity of your farm, you can use these figures to determine how many cows the place will provide roughage for. If it will produce 175 tons of silage and 25 tons of alfalfa, it will supply the roughage needs for 50 cows to produce a full carload of beef.

If it can produce only half that amount of roughage, your farm beef power, measured in production of feeder calves, probably would not be more than half a carload each year. For a rapid, but less accurate method of calculating your farm's ability to supply roughage, Mr. Moxley observes that about one acre of average upland, or one-half acre of good bottom land, will normally produce enough roughage for one cow.

Having the roughage problem settled, your next consideration is that of pasture. In the Bluestem area, about 5 acres of native grass are required for each cow. Like the figures on cropland, this must be adjusted to fit your farm or ranch. If you live in one of the shortgrass areas of Western Kansas, you might decide to allow 10 acres or more of grass for each cow. If you operate a general farm in Eastern Kansas and make most efficient use of small grain and temporary pasture crops, you might plan to do the job with only one or two acres devoted to pasture for each cow.

That outlines the feed requirements of a cow herd except for one important detail. Many farmers do not have silos, so Mr. Moxley gives extra information to help in figuring their roughage needs. He says 1½ tons of dry roughage such as fodder, prairie hay or straw can replace the 3½ tons of silage to be fed along with one-third ton of alfalfa as the yearly supply for one cow. Each cow should have a daily ration of about 15 pounds of the more common roughages and 4 or 5 pounds of alfalfa. In the absence of alfalfa, feed 15 to 20 pounds of dry roughage, daily, and add a proper protein supplement such as one pound of cottonseed meal. However, silage is considered the ideal roughage as it helps to keep the herd in good condition.

In figuring how much beef your farm will produce, Mr. Moxley emphasizes that kind of beef power is as important as amount.

For instance, cow herds on farms with little or no provision for roughage feeds and pasture, would be worse misfits than a small, row-crop tractor on a large Western Kansas wheat farm.

With this in mind, Mr. Moxley broadens his examples to include different types of Kansas beef production. Supposing you have less pasture and more good cultivated land than needed for production of feeder calves. If so, figure your farm's beef power for production of grain-fed or creep-fed calves. Raising creep-fed calves to be marketed for slaughter at a weight of about 750 pounds, you would need only 30 cows instead of 50 to produce a carload of beef.

In this case, pasture and roughage requirements of each cow are figured the same as for a cow producing a feeder calf, but with only 30 cows the total need for producing a carload of beef would be reduced nearly 50 per cent. However, the system of creep-feeding for slaughter calls for about 30 bushels of grain for each calf, an item that was not necessary in the feeder-calf plan.

In other words, on average cultivated land, the grain-fed calf system requires about one acre of land to provide grain for one calf. This acre is in addition to the acre of upland or half-acre of bottom land to provide roughage for the calf's mother, and whatever pasture acreage is necessary for the cow's grazing needs.

If this plan also shows a need for too much pasture in proportion to your cultivated land, there is still another popular system which features handling of light cattle. Widely known as the deferred-feeding system, it eliminates the cow herd and calls for purchase of feeder calves each fall. Calves are brought thru the winter on roughage and a light allowance of grain. In the spring they are turned on pasture for about 3 months, and at the end of that period they are put in the lot for 90-100 days of full-feeding.

Roughly comparing the feed requirements of this plan with the others, it is noted that 3 calves carried a year in this manner require about the same amount of grass and roughage as required by 2 cows in the calf-producing plans. In addition, each calf under this system usually consumes about 40 bushels of grain. With this grain, the average calf consumes about 2 tons of silage, one-third ton of alfalfa and 280 pounds of cottonseed meal. In the Bluestem area, this calf would require about 3 acres of pasture, as compared to 5 acres needed for a mature cow in the same area.

The standards given for these 3 forms of beef production represent the minimum yearly needs for each kind of cattle. If you wish a reserve feed supply, or if

you foresee need of extra feed for heifers or other additional animals, allow the necessary acreage for those purposes.

Pointing out the possibilities of utilizing Kansas crops in cattle production, Mr. Moxley declares that, year in and year out, no other crop in Kansas will give as high returns as a good sorghum crop marketed thru livestock. As convincing evidence, he reminds that one ton of sorghum silage, supplemented with proper proteins, will produce about 60 pounds of beef gain.

Therefore, land yielding 10 tons to the acre is capable of producing 600 pounds of beef to the acre. With good feeder calves now selling at about 12 cents a pound, such land in sorghum crops may return as high as $72 an acre. The same land in wheat would probably yield around 25 bushels to the acre, and figured at $1 a bushel, that wheat would give an acre return of only $25. Supposing the same land in corn would yield 35 bushels to the acre. At present prices it would probably sell at about 75 cents a bushel, giving an acre-income of only slightly more than $25.

Recognizing that all prices are at a high level now, Mr. Moxley calls attention to the value of an acre of sorghum, fed as silage, over a long period of time. The average price of feeder calves over a 20-year period, he says, is 8½ cents a pound. At this price, the 600 pounds of gain produced by the 10 tons of sorghum silage would have an average worth of $51.

Having the man output of beef rated at one carload, you may wonder whether a carload of beef will return enough to pay for your time. Mr. Moxley gives figures to help you decide. Still using calf production as the basis, supposing you produce your carload of beef in the form of 50 feeder calves weighing 450 pounds. They would total 22,500 pounds of feeder calves. Figuring them at 12 cents a pound, in line with present prices, they would bring a gross income of $2,700.

Figuring on the 20-year average feeder calf price of 8½ cents a pound, they would bring a gross return of $1,912.50. Mr. Moxley calls attention to the fact that a large part of the feed creating this gross income is roughage and waste products having little cash sale value.

The man with 30 cows, producing creep-fed calves to be sold at a weight of 750 pounds, would also market 22,500 pounds of beef. He might expect a slightly higher selling price and a larger gross income than received by the producer of feeder calves. However, his gross return represents less use of cheap feeds and greater use of grains and other more expensive feeds.

Chickens on Shares

Condensed from Farm Journal and Farmer's Wife

FARMERS around Harrisonburg, Virginia, are putting out 3,000,000 baby chicks each year, and more than 2,000,000 of these are raised on shares. The plan, briefly put:

A farmer gets chicks, feed, fuel and litter from a nearby feed company or hatchery. When the chicks are raised and sold in the fall he pays for chicks, feed, fuel and litter. Out of what is left he gets three-fourths and the dealer one-fourth.

This share plan started nearly ten years ago with Charles W. Wampler, who had given up his job as county agent and with his brother had gone into the farm supply business. A farmer proposed to him that they raise some chickens on shares and divide the profits. Without any precedent they thought a 50-50 split would be about right after taking out the cost of chicks, feed, fuel and litter.

"My brother said we should have nothing to do with it," Mr. Wampler relates, and so he decided to handle the matter on his own.

"When we settled up in fall, I had $300 for my share," he says. "I showed it to my brother and told him that if he hadn't been so set in his ways, half of it would have been his. Then he became interested and we decided to do more with the idea."

On the basis of that first transaction, they agreed that the grower ought to have a bigger share, say two-thirds instead of half, and that's the basis on which the share plan got under way. Later they raised the grower's share to three-fourths (after paying for chicks, feed, fuel and litter). Other firms have put the plan to work around Harrisonburg.

The reason the share plan has worked, Mr. Wampler contends, is the high regard which farmers in that area have for their obligations. For the most part, operations are carried on without a written contract. There is no chattel mortgage on the chicks. A simple contract is written when a flock-owner gets his first batch of chicks. This is never rewritten. If it turns out that a farmer is not reliable, he is dropped.

A similar share plan is followed with turkeys (Harrisonburg is the "Turkey Capital" of the Shenandoah Valley "Turkey Empire"). There is this difference: instead of the grower getting three-fourths of the proceeds (after costs are out), he is given a guarantee of 5% of the gross receipts from poults raised, and

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in addition, he receives 60% of the proceeds after cost of poults, feed, fuel and litter are taken out.

Another chickens-on-shares plan that has flourished is being used by junior flock-owners in Tennessee. It started in Lawrence county in 1939 when the Lawrenceburg Lions Club sponsored a plan for putting out baby chicks to about 300 4-H'ers and Future Farmers (50 chicks and 50 to 100 pounds of starting mash to each one). Now the plan has spread so that 4,000 young farmers are raising a quarter of a million chicks a year on shares.

Each boy or girl who gets 50 chicks signs an agreement to return ten or twelve of the best cockerels at the end of 25 weeks as payment for chicks and feed. If a person gets more than 50 chicks or 50 pounds of mash, the number of cockerels to be returned is increased accordingly. Flock-owners agree to feed all the mash, to raise the chicks as directed by county farm and home agents or vocational teachers, and not to eat or sell any chicks until final settlement.

This plan was in operation in 25 Tennessee counties in 1941, and it looks as if it will be used in 50 counties this year. Business groups, civic clubs and banks are using the plan to get young folks started in poultry, and thus help to reach Secretary Wickard's poultry and egg production goals. For the most part, utility breeds (Barred Rocks, White Rocks, White Wyandottes, New Hampshires and Rhode Island Reds) are used. An effort is made to interest each community in a single breed. Pullets are kept on the farm as foundation stock for a purebred flock.

When poultry is ready to sell in the fall, the junior flock-owners really make something out of it. In Lawrence county, for instance, the 300 flock-owners held a two-day poultry festival, featuring a parade with floats and a festival queen. They delivered 3,000 cockerels, which were sold for 14 cents a pound (1940, that was).

In Obion county, 270 boys and girls delivered 3,826 Barred Rock cockerels to make up a solid carload shipment to New York, where the birds sold for $2,024.42 —a profit of $641 above cost of chicks, feed and marketing. In most cases the cockerels are sold at auction to local produce dealers, who are able to pay a premium because of volume, uniformity and quality.

Still another plan for raising chickens on shares is being used here and there in the Corn Belt by produce buyers who have difficulty getting enough birds of the quality they want for their packing plants.

For example, there is a hatchery at Boone, Iowa, which is

operated in connection with a produce buying firm. Two years ago hatchery manager Earl Baron started a project with 1,600 high-grade New Hampshire chicks to prove his contention that there is a definite profit in raising poultry, if you have good chicks, good management and sound feeding. Since that first venture he has started other projects. Results have verified his belief. Mr. Baron outlines the plan:

"We start a farmer with 2,000 chicks. These are placed in five 12 x 16 brooder houses, 400 to each house. We separate them at six to seven weeks of age into five other houses, keeping the pullets and roosters separate and carrying these birds until they reach market weight. We have found we can successfully run through four batches each year — two bunches to roaster weight (five pounds) and two bunches to frying weight (three pounds).

"As to financing, we supply baby chicks, commercial feed and supervision. We feel that supervision is the most important part; that represents the difference between profit and loss. We also supply the brooder houses and electric brooder stoves.

"The poultry grower furnishes all the grain (such as oats and corn), the miscellaneous equipment (such as feeders and waterers) and all labor.

"We keep records (so does the flockowner) on each project. We find it takes approximately 220 hours of labor to take care of 2,000 chickens to roaster weight.

"The houses are constructed of insulating material, round roof, with removable ends — one set solid for winter use, the other with wire for summer use (which makes a combination brooder and summer range shelter). We use 12½ gauge wire floors (1 x 2-inch mesh), laid over 2 x 4's on 16-inch centers, which eliminates the litter problem. To start the chicks, we use tough waterproof paper until the chicks are six weeks of age. On this paper we use cottonseed hulls for litter (at the start).

"This being a partnership plan, the proceeds are divided when final sales are made. The flockowner gets 75% of the net profit and we get 25%. Each 2,000 chick project costs the grower about $250. Our investment is around $1,100. The average profit to the grower has been around $235 for 2,000 chicks. Feed costs have averaged about eight cents per pound of poultry produced. Some other things we have found out:

"As a procurement proposition for midwest produce plants, the method is sound. Also, it assures a profit to the grower, which is essential.

"Starting the chicks with a starting feed, then changing to a

balancing feed at six weeks, enables the farmer to use a maximum of home-grown grains.

"To avoid breast blisters, chicks must be roosted at six weeks of age. We are using 1 x 3-inch boards laid flat on the floor, lengthwise of the house."

Hay Cutting Time Vital

Condensed from Missouri Farm News

THE time of cutting is the most important single factor in producing a good crop of hay that is under control of the farmer, says J. R. Paulling of the University of Missouri College of Agriculture. This is true from the standpoint of both quality and quantity.

Tests at the Missouri Experiment Station show that timothy cut in the full bloom stage yielded more pounds per acre of both total digestible dry matter and protein than that cut at any other stage. The crop cut at this stage yielded 20% more digestible dry matter and 50% more protein per acre than the timothy cut when the seed was ripe. Cutting in either the early bloom or dough stage both gave much lower yields of feeding value per acre than cutting in full bloom.

In tests at other stations, 1,628 pounds of alfalfa cut in the bud stage produced as many pounds gain on cattle as 3,910 pounds of alfalfa cut when dead ripe. Thus the early cut alfalfa was worth nearly 2½ times as much as the late cut. Red clover, cut when in the stage of from one-third to full bloom, gave both the highest yields of protein per acre and the largest feed yields.

The best results can be expected from cutting alfalfa when the buds at the base of the plants have just started. However, to prolong the life of the stand, one crop during each year should be allowed to reach the full bloom stage before cutting.

Red clover should be cut when one-third to full bloom. Mammoth Red should be cut at this same stage, and alsike is best cut a little later or when a number of brown seed heads appear. Timothy and red top should be cut when in full bloom. Small grains used for hay should be cut in the milk stage.

Lespedeza should be cut at that stage when the leaves have shed about as high on the plant as the mower cuts. Leaving a number of live buds on the lespedeza stubble assures a quick second growth. Soybeans produce hay to best advantage if cut when the pods have just begun filling and before any leaves have dropped.

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Conservation Farming and Yields

Condensed from Soil Conservation

R. E. Uhland

Liaison Officer, Research-Operations, Soil Conservation Service, Washington, D. C.

THE present war is calling for increased production of many important crops. More than ever before, any recommended soil conservation measure will need to be evaluated on the basis of its effect on production or yield as well as its effectiveness in conserving soil and water. Costly mistakes in the unwise use of farm land during and following the last war must not be repeated.

Farmers have never been as concerned about data on saving the topsoil as about greater yields from land on which conservation measures are used. Partly for this reason extensive evaluation studies and field tests have been carried out over a period of years on many soil conservation projects. These studies greatly supplement the data secured on conservation experiment stations and furnish factual field data on the effects of conservation practices on yields.

The findings reported in this article show that conservation farming, including proper land use and supported by needed soil conservation measures, insures immediate and continuing increases in crop yields. These data are taken from different sections of the country and are quite indicative of results that can be expected from conservation farming.

In the Estancia Valley of New Mexico, where rainfall is limited, contour farming supported by terraces yielded 47.3 percent more beans for the 4-year period, 1936 to 1939, than did similar fields that were unterraced and farmed in straight rows. Thirty-four unterraced fields with straight rows were compared with 22 similar fields that were terraced and contoured. The difference in favor of the treatment ranged from a minimum of 12.1 percent in 1936 to a maximum of 82.3 percent in 1939.

Similarly, in 1939 wheat yields on nearly 200 fields in the Southern Great Plains were 31.3 percent greater where the land was terraced and contoured. The average yield for the terraced and contoured fields was 16.8 bushels per acre as compared with but 12.6 bushels where the land was

Reprinted by permission from Soil Conservation, Washington, D. C., May, 1942

farmed in straight rows without regard to contour. On two of the seven projects on which yields were taken, the rainfall was above average and well distributed, and thus there was little difference in yield between the treated and untreated fields. Yields taken on a limited number of fields in 1940 showed similar increases for the treated fields.

Conservation measures applied to cotton fields in the Southern Great Plains also greatly increased yields. Near Spur, Texas, the yield of lint cotton on contoured land with closed level terraces was 68 pounds per acre more than on adjacent unterraced and non-contoured land. The value of this increased yield of cotton, figured at the average price per pound received by farmers for each year of the 12-year period, 1927 to 1938, was $7.60 per acre each year. There were 3 years of crop failure in this 12-year period when two crops were destroyed by hail and one crop failed because of two extremely dry years in succession. If these 3 years were omitted, the annual return per acre from the terraced and contoured field was $10.13 greater than the return from the unterraced and uncontoured field.

The effect of contouring and terracing on the yields of grain sorghums was demonstrated in the high plains of Texas in 1937. The average yield of grain from 20 terraced and contoured fields was 723 pounds per acre as compared with a yield of 589 pounds per acre from land that was contoured only and a yield of 461 pounds per acre from land where neither contouring nor terracing was practiced. These increases were more significant on the heavier and finer-textured soils where water conservation was highly important.

In South Dakota, the average yield of small grains on contoured land over a 3-year period was 6 percent more than on land that was not contour-farmed. The yield of grain sorghum as a listed row crop was 19 percent greater than when surface-planted. This study shows the practical importance of listing for holding the topsoil. In 1940 the deeper topsoil produced 90 percent more grain than soils in the same area which had lost most of the topsoil. In 1941 the difference was 59 percent.

In the Northeast at Beemerville, N. J., land planted to corn and cultivated on the contour yielded 3 tons more silage per acre than corn planted up and down the slope. The contoured land lost but one-half as much water and one-eighth as much soil as noncontoured land planted to the same crop. In 1938, the yield of green silage from a field planted to a soil conserving grass legume mixture was 14 tons per

acre, as compared to a green silage yield of 9 tons per acre from an adjacent plot of corn cultivated up and down the slope. This practice is applicable and can be used profitably on many farms throughout the Northeast.

Potatoes at Beemerville, N. J., in 1941, yielded from 8 to 15 bushels more per acre when planted on the contour. In 1940 the increased yield from contoured land was 23 bushels per acre.

In the potato section around Presque Isle, Maine, both increases and decreases in the yield of potatoes have been reported. The decreases, however, were associated with ponding of water which injured the quality of the potatoes. Preliminary studies show that these defects can be corrected and contour farming can be effectively and economically used in potato production.

For a 6-year period an old established field of Concord grapes that was planted and cultivated on the contour produced an average annual yield of 4,842 pounds of grapes per acre as compared with a yield of 3,933 pounds from adjacent land cultivated up and down the slope. For the 4-year period, 1936 to 1939, when moisture was very limited, the contoured land yielded from 600 to 2,500 pounds of grapes more per acre than land with rows planted up and down the slope. In 1940, however, the rainfall was higher and better distributed, and as a result the yield of contoured grapes was 200 pounds less than that of uncontoured grapes. This slight difference occurred but once in the 6-year period, whereas the average increase in yields from contour farming was 23.1 percent.

The yield of corn at Zanesville, Ohio, declined where corn followed corn year after year. The average yield for this 5-year period was 20.4 bushels per acre when planted and cultivated up and down the slope. Corn grown in rotation with fertilizer and lime and contour strip-cropped increased in yield from 31 bushels in 1935 to 55 bushels in 1939.

At Clarinda, Iowa, contour-listed land planted to corn yielded 56.1 bushels per acre in 1933, while non-contour-listed land produced only 33.1 bushels. For a 6-year period that included 3 dry years when chinch bug and grasshopper injury was severe and little corn was produced, the average yield for contoured land planted to corn was 30 bushels as compared with a yield of 18 bushels from non-contoured land. This represents a difference of 12 bushels per acre in favor of contour farming. During this 6-year period, the contoured area retained 13 inches of rainfall more than noncontoured land. This represented an average annual

saving of more than 2 inches of rainfall and indicated that every inch of water saved resulted in an added yield of 5½ bushels of corn per acre.

Contouring of intertilled crops is on the steady increase throughout the country and can be profitably extended. According to the Agricultural Adjustment Administration, almost 6½ million acres of land was contoured in the southern region alone last year. Records show that practically no contouring was practiced in Iowa as recently as 1935.

Should this conservation practice be extended to one-third of the corn acreage of the Corn Belt, the annual production of corn would be increased by almost 100,000,000 bushels. This estimate is based upon hundreds of observations and is supported by experimental data.

At the New Jersey Experiment Station, tomatoes grown in alternate years with Sudan grass showed a 33-percent greater yield than tomatoes grown year after year on the same land. The mulching of tomato vines with 3 tons of straw per acre almost doubled the yield of tomatoes and improved both size and quality. Raspberry fields similarly treated increased in yield from 35 to 75 percent.

Champaign grapes that were mulched with straw at Hammondsport, N. Y., in 1939, yielded an increase of 98 pounds of grapes for each 100 vines over those not mulched. This represented an increase of 80 percent in the first crop harvested for the young vines.

On the Soil Conservation Experiment Station near Athens, Ga., it was demonstrated that critically eroded areas in the Southeast can be effectively cropped to lespedeza by adding lime and superphosphate and applying a light straw mulch. Without the mulch, the crop failed completely, but wherever a mulch was used a yield of 1½ to 2 tons of hay per acre was produced. This yield was quite comparable to the yields on the station from average cropland receiving the same fertilizer without mulch.

The practice of utilizing crop residues for surface mulching is quite different from the old method of burning or plowing under trashy vegetation and promises to change greatly the agriculture of many sections of the country. The problems presented in the utilization of crop residues vary widely in different sections of the country, and for this reason extensive studies are being carried out to determine the most practical adjustments needed for the different sections.

In order to secure factual information regarding the effect of soil loss on crop yields, a large number of fields were studied in

TABLE 1 — Depth of topsoil with yield of corn and percent of field represented by each depth class. Average for a large number of fields at Fowler, Ind., and Bethany, Mo., 1939 and 1940.

Depth Class (inches)	Fowler, Ind.		Bethany, Mo.	
	Field Area Percent	Yield Bushels per acre	Field Area Percent	Yield Bushels per acre
0	1.0	19.8	0.5	15.2
1 to 2	3.5	39.6	3.9	24.9
3 to 4	10.4	48.8	24.0	27.3
5 to 6	19.0	56.9	27.3	35.2
7 to 8	25.3	63.3	27.3	41.2
9 to 10	16.4	69.6	12.1	47.2
11 to 12	14.3	75.5	4.0	51.0
13 or more	10.1	81.5	1.0	57.4

Indiana, Iowa, Missouri, and Ohio. Since management is known to influence erosion, fields were purposely selected to represent different types of management. In table 1, the summary data for Fowler, Ind., and Bethany, Mo., show the very definite relationship existing between depth of topsoil and corn yields. Similar data were secured for Coshocton, Ohio, and Greenfield and Shenandoah, Iowa.

A striking example of the effect of conservation farming on production is furnished by 2 fields of Shelby silt loam near Bethany, Mo. The fields had been handled similarly prior to 1935 when a 3-year rotation supported by liming, manuring, fertilizing, and contour cultivation was initiated on one field. The other field was managed according to the old system of farming and no treatments were added.

In 1940, 5 years after conservation farming was initiated on one of these fields, a survey was made, the results of which are shown in table 2.

It will be noted that there is a close relationship between soil depth and yield on both fields, but there is a striking contrast in production levels. The average yield of corn for the treated field was 69.7 bushels per acre as compared with a yield of 32.5 bushels for the untreated field. Almost one-half of the area of the untreated field measured less than 5 inches in depth of topsoil; whereas, about one-fifth of the treated field fell into this depth class. The average depth of topsoil for the treated field was 5.9 inches as compared with a depth of 4.6 inches for the untreated field.

Observations showed that the soil losses from the field on which

TABLE 2

Effect of conservation farming on depth of topsoil and yield of corn, Bethany, Mo.

	Exploitive Farming		Conservation Farming (Since 1935)	
Depth of Topsoil (inches)	Field Area Percent	Yield Bushels per acre	Field Area Percent	Yield Bushels per acre
0 to 2	20.5	20.6	4.6	50.7
3 to 4	26.7	27.0	16.6	60.0
5 to 6	31.4	38.6	43.7	66.7
7 to 8	17.1	41.1	25.8	80.0
9 to 10	3.8	42.4	6.6	84.0
11 to 12	0.5	51.4	2.7	76.0

conservation measures were applied were very small since 1935, but the losses from the check-field were extremely large. It is recognized, of course, that these fields were not perfect checks; but it is significant that the field on which conservation farming was followed yielded more than twice as much as the field on which conservation practices had not been applied.

These results are in line with findings of State agricultural experiment stations. For example, the Indiana State Experiment Station reported an average yield of 39 bushels of corn per acre for untreated land cropped annually to corn, as contrasted with an average yield of 61 bushels from adjacent land treated with fertilizer, lime, and crop residues, and cropped to a 4-year rotation of corn-corn-wheat-clover. Under a 5-year rotation of corn-corn-soybeans-wheat-clover in a livestock system of farming where fertilizer, lime, and manure were used, the average corn yield was 64 bushels per acre. These yields were taken during the 11-year period, 1928 to 1938. In both livestock and grain systems of farming, the yield of corn that followed red clover sod in the rotation averaged 11 bushels more per acre than did corn following corn.

These factual data are presented from different sections of the country to show that conservation farming, including proper land use supported by needed soil conservation measures, reduces runoff and erosion and insures immediate and continuing increases in crop yields. While increases of the same magnitude cannot be expected for all locations, nevertheless farmers who have applied conservation measures on their farms have experienced increases in crop yields.

The Vitamin B Complex in Swine Nutrition

Condensed from Hog Breeder

Dr. Harrison H. Havner, D.V.M.

WHEN Funk coined the term "vitamin" in 1911, he had no way of knowing the complex nature of the "vital amine." Subsequent research, however, has shown that vitamins fall generally into two groups: Fat-soluble and water-soluble.

Of the two groups the fat-soluble vitamins have been identified more closely with definite chemical compounds. Better known fat-soluble vitamins are: Vitamins A, D, E, and K.

The water-soluble vitamins are more elusive. Some of them have been isolated, others are known only from their biological activity. At least 24 water-soluble factors have been mentioned by investigators. Some of these, no doubt, are duplications and possibly fractions of other vitamins. Many others remain unknown because it has been only a little over a score of years that scientists have been studying the vitamin make-up of rations in detail. The better known water-soluble vitamins are: Thiamin or B1, Riboflavin, Pyridoxine, or B6, Pantothenic Acid, Chlorine and Niacin (formerly called nicotinic acid).

The Niacin factor has definitely been established as the pellagra preventative factor in humans and the black tongue preventative factor in dogs. Davis, Freeman and Madsen of the Michigan State College have shown the relation of nutrition to the development of necrotic enteritis in technical bulletin No. 170, reading:

"Rations supplemented with nicotinic acid have prevented the development of necrotic enteritis in the same environment where pigs fed the same rations but not so supplemented have developed the disease.

"Liver, yeast and particularly nicotinic acid have been fed with remarkable results both as a cure and a preventative of necrotic enteritis.

"It is suggested that the disease, infectious necrotic enteritis, is a secondary complication caused by intestinal invasion of the organism, scholeragsuis, and probably other organisms after the symptoms of a deficiency of nicotinic acid have developed in the pigs."

This preliminary research work leads us to question "Are vitamins essential to pigs?" The answer seems to be in the affirmative. It has definitely been es-

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tablished by research workers that the control of necrotic enteritis can be helped through proper nutrition. That part of the vitamin B complex known as the Niacin factor—the same factor that corrects pellagra in humans —assists in correcting the dreaded disease known as "Necro," sometimes called "Pig Pellagra."

Proper nutrition, however, should not be limited to the grown pig. Proper nutrition should go back to the brood sow if she is to produce strong sturdy pigs. The nutritive factors provided by the Vitamin B complex, which includes the Niacin vitamin — definitely contributes to strength and improved vitality of pigs at birth. The B complex blend of vitamins helps to avoid weak or stillborn pigs.

The National Planning Committee, of which Secretary of Agriculture Wickard is the head, requests over two billion extra pounds of pork in 1942. The increase of one more pig raised per litter would more than accomplish this goal. And, swine breeders and commercial hog feeders are very much of the opinion that added profits will result if a balanced nutrition program for swine is followed in 1942. Such a program should, for the most forward progress, include consideration of the B complex vitamins, which provide the added plus factors in producing more raised pigs per sow in addition to helping prevent pig trouble such as necrotic enteritis.

There is one further point that is worth attention by hog feeders. Dr. Supplee of the Borden Research staff has shown in his human diet studies the importance of introducing the B complex group of vitamins into the diet from a natural source. The combination and relation of the component parts of the B complex from a natural source seems to produce results far beyond the contribution that can be made by single or separate vitamins of the complex. This procedure probably explains the variance in results that have been reported by investigators when experiments have been conducted with single parts of fractions of the B complex. Probably much of the value attributed to the interrelation of factors is actually due to unidentified parts, or unknown factors, which are included in the natural source but obviously cannot be supplied in mixtures of pure vitamins. Research workers generally are accepting the contribution being made by the B complex to balance swine nutrition. This is particularly true if a natural source or a natural blend of the B complex is used in swine rations to supply these plus factors so important for the best results and the most hog profits for the farmer.

Sulfur and Charcoal Prevent Coccidiosis

Condensed from Pacific Rural Press

Donald L. Kieffer

RECENT research in the prevention of coccidiosis by O. E. Goff of the Louisiana Experiment Station has disclosed that flowers of sulfur and hardwood charcoal gave excellent results.

He found no drugs or medicants which could overtake this parasite and kill it once it has entered the intestinal linings. Prevention has to be the angle of attack. Sanitation is the foundation of prevention and sulfur seems to be most helpful in providing sanitation under controlled or guarded conditions.

Out of seven types of coccidia, these experiments have been limited to only one. This is Eimeria tennella which concentrates in the ceca or blind intestine and causes bloody diarrhea. Once oocysts enter the intestines they develop sporozoites which actually accomplish the penetration of intestine linings. It is this sporozoite stage which the sulfur effectively attacks. If chicks survive the hemorrhage which occurs on the fifth day after the infective material (containing oocysts or eggs) has been swallowed, they usually live, whether or not a drug or tonic of any kind is administered. In those which die the ceca is found to be filled with blood. The oocysts may live in the soil for 18 months or more. They thrive in warm mud.

These experiments found flowers of sulfur and No. 10 hardwood charcoal most effective in combination, as shown by this table:

Ration	Per Cent of Chicks Surviving
No Sulfur	6.6
2% Sulfur	62.2
2% Sulfur and 5% Charcoal	84.4
5% Sulfur	88.9
5% Sulfur and 5% Charcoal	97.8
No Sulfur and 5% Charcoal	11.1

Sulfur must be fed at least one day before it can give protection. Infection is again possible one day after discontinuing sulfur.

If a poultry operator is sufficiently able to detect the very first symptoms of coccidiosis in his chicks he may depend upon the following method of treatment. After the first symptom mix 5 pounds of sulfur and 5 pounds of charcoal with 90 pounds of all-mash chick feed. Discontinue feeding grain for the period of this treatment which should be maintained from seven to fourteen days. If treatment is

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given during a period lacking sunlight it is necessary to take special care to avoid sulfur rickets by increasing the vitamin D ration content (400 AOAC chick units per gram is ample in 100 lbs. of feed). Clean the house daily and keep the chicks dry and warm as a matter of course because the sulfur can not substitute for sanitation. Infections usually continue showing for five or six days after treatment begins.

If sulfur is fed before chicks are four weeks old their growth may be retarded. The area about the face, under the wings and around the vent usually become irritated. The irritation is less, the older the chicks. Once mortality is checked the sulfur and charcoal can be discontinued after seven days, but fourteen days are better and ill effects are not important.

If chicks are to be grown out on the range grow them in confinement for at least four weeks or up to eight weeks away from sources of infection. Two days before they are to go onto the ground begin feeding 5 per cent sulfur and 5 per cent charcoal. Continue this until they have been on the ground for five days. Then switch to an all-mash ration containing 2½ per cent sulfur and 5 per cent charcoal. If mash and grain feeding is to be followed, use hoppers and load the mash with 5 per cent each of sulfur and charcoal. This will give a total intake ratio of 2½ per cent of each if care is taken to control the consumption of both mash and grain by the flock. In this situation the 2½ per cent of charcoal is practically as effective as the 5 per cent amount. Chicks can safely be fed this way from 12 to 16 weeks of age by which time they have largely passed the susceptible stage. In cases where wet, warm yards teem with infective organisms, massive infective doses may sweep a flock. Poultrymen who have tolerated such a condition may safely feed up to 10 per cent of sulfur in the ration for short periods and overcome such a flareup.

The Washington experiment station reports on other sulfur compounds: Sulfanilamide, the mighty drug of medicine today, was not effective at 0.3 grams per bird per day and prevented normal gains in weight due to toxicity. This, and lesser doses were sufficient to control some of the other six species of coccidiosis and this likewise is true of some of the other sulfur drugs tried.

Even 0.7 per cent of Sulfapyridine in the mash was not effective on E. tenella and the cost was high. From one to five per cent of sulfaguanidine in the mash effectively stopped blood showing in the feces but had no curative effect upon infected birds. Later

experiments do hold some promise. Costs $30 per pound, however.

Aqueous (6.14%) colloidal sulfur at the rate of three parts of the mash was effective in preventing cecal coccidiosis while one per cent in drinking water was not.

Wild Horses of the Plains

W. O. Roberts

Superintendent, Pine Ridge Indian Reservation, Pine Ridge, S. D.

WHEN Christopher Columbus landed at San Salvador, ending the fateful trip across the Atlantic, he found a strange and different people. Since the great explorer thought he had reached India, he called the people Indians. Following this epochal voyage, the European nations immediately sent out exploratory and colonization enterprises to exploit the new country. Horses were not among the fauna of the new world. Fossil remains have been found of the earlier horses in Wyoming and other parts of the United States, but there were no native horses at the time of the discovery.

The Spanish explorers in both the southwest and southeastern areas brought horses with them. The officers and wealthier members of the expeditions usually brought Spanish Jennets or Moroccan Barbs. The ordinary members and the less wealthy used a less expensive horse, though one which was useable and dependable.

Many of the exploring parties encountered savage resistance by the Indians, with the result that some of the horses escaped. DeSoto set free six of his horses on the west bank of the Mississippi south of the mouth of the Arkansas in 1539. While the horse has long been domesticated by man, the fact remains that horses are the easiest of domestic animals to return to the wild state. Accordingly, the horses released by these expeditions found in the lush grasses, running streams and satisfactory climate a perfect habitat. These Spanish horses were the foundation of wild herds, some of which were later domesticated by Indians of the plains and western areas.

Later on from English and Dutch settlers, horses of the northern European type escaped, becoming wild and moving on ahead of the western migrations, the numbers increasing as the years went by. From out of these original stocks, various tribes of Indians captured some of the

animals and learned to use them to ride, to carry loads and pull a travois-like conveyance.

From these beginnings certain definite types of horses began to appear. Among the more important and best remembered are the Mustangs, Cayuses, Bronchos and Appaloosas. The terms Mustang, Cayuse, Broncho, Bronc or Indian pony, are colloquialisms and are largely interchangeable names applied to early western horses. In a general way the animals were similar, being about 13 to 14 hands high and had good feet and legs.

The Broncho is characterized by a rather large head, thick short neck, has well sprung ribs and good back. Mane, tail and forelock are quite heavy, all colors prevail.

Mustangs swarmed all over the plains, were tough, fast, and surefooted. They trace directly back to the early Spanish cavalry horses.

The Cayuse was, practically speaking, the same horse, but was so named from the Cayuse Indians who captured and domesticated the wild horses soon after the importations.

The Appaloosa type traces directly to the aristocrat of the Equine world, the Moroccan Barb. The Nez Perce Tribe had very early been intrigued by the spotted coloring and fine conformation of this horse, and had developed it to a remarkable degree. The Nez Perce Indians are the only Indians who had progressed in the arts of animal husbandry to the point of gelding inferior males. By selection they had developed a horse which met the standards of their time admirably. It was remarkably fast—it could "turn on a dime" and was highly tractable which made it a perfect buffalo horse. The origin of the Appaloosa horse is the Morcoccan and Spanish Barb. According to Albert W. Harris, President of the Arabian Association, the Barb and the Arabian are essentially the same horse. The Appaloosas are characterized by peculiar leopard-like spots usually predominating over the hips. Frequently the tail is sparse, and a ring of white surrounds the eyes. This peculiar white ring was thought by white settlers to be an indication of vicious temperament, though the Appaloosa horse is really one of the most docile of horses. The fact that the Appaloosa horse was developed by Indians and had such a high place in the Nez Perce tribe is good reason for renewed interest in this breed by the Indian Service. The Pine Ridge jurisdiction has selected a few of these animals for observation and study. Iron Cloud of Porcupine, S. D., has a registered Appaloosa stud which he uses in his cattle work and which he prizes greatly. Left

Hand and Ghost Bear each have a good stud of this strain. While this breed will not be made the dominant strain in the Pine Ridge horse program, Indian people may well have an interest in this fine little horse, not only from the sentimental side, but from the very practical one. It is too bad that the early efforts of the Government and missionaries dispersed these animals away from their original habitat. The Appaloosa Horse Association with headquarters in Moro, Oregon, is attempting to reestablish this type of horse as a distinct breed and should have the support of all horse-loving people.

The development of the Colorado Ranger horse is an interesting comparison. General Grant, himself a great lover of good horses, during his travels following his presidency, was presented with two fine stallions by the Sultan of Turkey. One of these studs, "Leopard" was pure Arabian and the other, "Linden Tree," was pure Barb from Morocco. General Colby, an army friend of General Grant, removed these horses to Colby's ranch in Nebraska in 1894 which was stocked with "native" mares. Colonel Bradley of the U. S. Cavalry brought some of his privately owned mares to Leopard, the Arab, and by mating two of these offspring got later an unusually fine stud colt "Patches" listed as No. 1 in the registry of the Colorado Ranger Breed. The "native" mares, without doubt, were the "Wild Horses of the Plains," tracing back to Arabs and Moroccan Barbs. Only mares tracing directly back to Leopard and Linden Tree are permitted registration in the Colorado Ranger Registry. In the male line importation of pure Moroccan barb stallions has reinforced the basic blood.

It seems clear then that the Appaloosa and the Colorado Ranger breeds have the same basic origins. The Appaloosas made their entry into America by way of the early Spanish conquests in the sixteenth century. The Nez Perce Indians specialized in this type of horse leading to the present-day Appaloosas, of which a few hundred are left and which the Appaloosa Horse Club of Moro, Oregon, is attempting to reestablish, bringing the breed back to the high standard maintained by the Nez Perce Indians a century ago.

The very same basic stock introduced three centuries later produced the Colorado Rangers. While the breeds are not identical they are very similar. The Ranger is heavier, due very likely to the use of larger mares in the development period. An Appaloosa is about the size of an Arabian, a Ranger about 150 pounds heavier. There are in-

stances of an animal carrying registry in both associations. It is not unlikely that a merger may result not too far in the future.

It is to be regretted that the Indian Service and others working with Indians failed to record the true facts about Indians and their horses before the advent of the automobile; that Indians were truly great horsemen, capable of highly efficient horsemanship, is an undisputed fact. One of the greatest rides of history was by Black Elk, a Sioux Indian, who made the remarkable ride of more than a hundred miles a day for several days in succession. Red Calf, another Sioux, not only was a remarkable rider, but he had a horse of such quality that it was purchased and taken to Africa and used for breeding purposes with the original Arabian. The progeny of this remarkable horse rated with the best of the Arabian stock.

The Sioux economy was based on the buffalo, food, clothing and shelter being derived very largely from these plentiful animals. In order to hunt them successfully a fast and well-trained horse was required. The horse had to be fast enough to run with the animal and tractable enough to ride close so that the hunter could discharge an arrow at closest range into the fleeing animal. The horse had to be quick enough to dodge the murderous horns of a wounded buffalo and fleet enough to escape the stampede. He had to be sure-footed and alert to dodge the prairie dog holes and other rough and difficult ground.

When the Sioux were driven out of their original home around the lake country, they were a badly beaten and depressed people. Their state was weak and well nigh hopeless. Providentially, the horse revolutionized the complete and entire outlook. The Indians were transformed from helplessness to successful hunters and proud and haughty warriors. They were able to travel great distances following the buffalo and escaping or attacking their enemies.

This article could not hope to go into the full matter of the rich and glorious history of the Sioux and their horses. The tradition, however, should be maintained by Indian people and as fully as possible made of record for future generations.

Fundamental Principles of Disease Control

Condensed from The Shorthorn World

J. F. Bullard, D.V.M.
Purdue University

THERE are certain principles or facts that should be known if we are to prevent and control the spread of disease intelligently. All infectious diseases are caused by some specific organism which must gain entrance into a susceptible animal. Therefore, if we know something about the way an infection is spread we can then develop the proper methods to prevent it. The fundamental principles which concern us are somewhat as follows:

1. The channel of elimination from the infected animal.

We must know by what route infection is eliminated. This varies with different diseases and it is necessary to know in order to take proper precautions. With some diseases the avenue of elimination is from a single tract while with others it may be discharged from more than one. With tuberculosis, the infection is discharged from several channels depending upon the part of the body involved. It may come from the lungs, the digestive tract, the udder, or the reproductive and urinary systems. With Bang's disease the reproductive system is the main channel of elimination of infection although it may be eliminated from the udder. With a disease like coccidiosis the only channel of elimination is the digestive tract.

2. The time during the course of the disease when the infection is discharged.

This is an important point to consider because if it is known when infection is being eliminated the results from a quarantine period will be most effective. The two diseases previously alluded to can serve again as good examples. With tuberculosis of the lungs or in any other part of the body that is in direct communication with the outside there is always danger of the animal acting as a spreader and the infection is usually being discharged constantly. On the other hand, with Bang's disease about the only time the infection is being discharged is at the time of abortion or freshening and for a period of approximately a month after either of these acts. The infection is found quite frequently in the milk of infected animals also.

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This fact is usually of greater consequence to the dairyman than it is to the beef cattle man.

3. The state of the infectious material outside the animal body.

Less can be said in a definite way regarding the presence of the infectious material outside the body than was stated for the first two topics. The ability of the infectious agents to resist outside conditions varies considerably and this depends entirely upon the type of the bacteria concerned. Some are extremely resistant to atmospheric conditions and also disinfectants. This is due in some cases to the fact that certain bacteria are spore formers. This stage may be likened to a seed of a plant. When dry, the seed does not develop but lies dormant. Then, when proper conditions such as temperature and moisture are provided, it develops rapidly. With these spore forming bacteria proper conditions are supplied when they enter the animal body. Here they change quickly into the vegetative forms which multiply rapidly and produce disease.

All bacteria are affected by sunlight. When outside the body, if they are covered by manure or soil or are protected in any way, they will live much longer. Therefore, thorough cleaning of the pens and stables is necessary in order to allow sunlight and disinfectants to come in contact with them if they are to be destroyed.

4. The channel of entrance of the infection into the animal body.

It is just as important to know how infection gets into the body as how it gets out. It may generally be stated that the majority of infectious diseases are contracted by way of the digestive tract. This is an interesting point in that many diseases are confined to widely separated systems or parts of the body. Still the infection gains entrance through the one common channel. With some diseases the causative bacteria may enter by more than one route. The way the infection enters has no bearing on the type of disease as both acute and chronic ones are contracted by bacteria entering either the same or different ways.

Another method by which disease is contracted is through the introduction of the infection by certain types of insects. Here there is a direct innoculation of the infectious agent into the tissues and blood. There are only certain sections of the country where cattle owners are concerned with this type of disease transmission.

If all these facts concerning the spread of infectious diseases were understood thoroughly, we would be very much farther advanced in our control program than we are. Fortunately great strides

have been made along these lines but still there is much to be done. If we keep in mind the above principles as outlined, they should enable us to work more effectively in combating disease. Our aim then would be to confine the infection to the sick animals and at the same time to protect the non-infected ones from exposure. Such a quarantine procedure not only works during the actual disease outbreak but is an excellent practice to follow when purchased additions are brought into your herds.

There are other effective measures employed in the control and eradication of disease in addition to what has already been stated. Everyone knows that the quickest method of control is to dispose of all infected animals for immediate slaughter. In many instances this causes a hardship and as a result, modifications of this procedure have been employed. However, with some diseases such as foot and mouth disease there is only one alternative and that is immediate slaughter of all exposed and infected animals, with subsequent destruction of the carcasses by burning or deep burial. This seems radical in nature since the disease does not have a naturally high death rate. One must, however, be far sighted and survey the entire livestock industry. While this method is costly at the time, it has, nevertheless, proved its worth. To verify this we have only to look back and compare results in this country with those of other nations throughout the world. In many of them this disease is present almost constantly. If all factors concerned were considered, one could easily see, in the long run, that our procedure was by far the least costly.

Protective Vaccination

Protective vaccination as practiced with certain diseases has been demonstrated repeatedly to be highly effective in protecting susceptible animals against infection. In many sections of the country such diseases as anthrax and blackleg are so devastating that it would be almost impossible to raise cattle if it were not for the efficient immunizing agents used. Vaccination against these two diseases has been done for many years and in those sections where they occur, the results are well known to all breeders.

While vaccination has been practiced on cattle to protect them against Bang's disease, it has been only in the last several years that it has come into wide use and is especially recommended for calves. As this disease is very wide spread it might be advisable to discuss it somewhat more in detail a little later.

Diagnostic and Biological Tests

In addition to protective vaccination there is one other general

procedure of vital importance that should be stated briefly. It is the use of the various diagnostic and biological tests that can be applied for the detection of infected animals. These tests have been perfected for only a few of our common diseases. Two of the most common ones are the tuberculin test for tuberculosis and the blood test for Bang's disease.

It should be emphasized here that any of these various tests are solely for the diagnosis or recognition of infection. The value of them is twofold. They pick early cases before infection has developed to the point where the animal is a spreader. Such cases can be removed before any harm has been done. Secondly, the repeated application of the test at proper intervals will give one an excellent idea as to what progress is being made in the control program. Repeated tests are valuable in picking animals that did not show positive on the initial test although they were infected at the time. This is due to the fact that different individuals require varying lengths of time for the body reaction to develop so that when the second test is applied, it will usually show the animal to be infected.

All livestock people know that there are many diseases affecting cattle but only a few are of major importance. We hear of some more than we do of others. This depends to a large extent in what part of the country the breeder is located. Some diseases are much more common in one section than in another while some are entirely confined to certain sections.

Two Bucks on Tractor?

A tractor with fast road gear and power lifts is an ideal unit on which to mount a hay buck. J. E. Witte, Jr., Knox county, Indiana, built a buck to mount on the rear of his new outfit.

With it he backs into a windrow until he has rolled up a big load. Then he lifts the load off the ground and carries it to stack or barn. Ends of the teeth may be lifted 3 feet from the ground with full load. That slopes them so hay will stay on. If there is a tendency for the hay load to lift the front tractor wheels off the ground. Mr. Witte says he intends to buy a manufactured buck for the front end of the tractor and bring in 2 buck loads each trip instead of one.

—*Capper's Farmer*

Making Cheese at Home

Condensed from Texas Farming and Citriculture

ONE of the most primitive forms of husbandry was the milking of cows and the separation of the curd and whey of sour milk by means of rennet, extracted from the skins of the stomachs of calves, for the purpose of making a crude form of cheese.

The art is mentioned in the Old Testament (1 Samuel 17:28) and surviving from the first century after Christ are exact recipes for cheese making. As the centuries passed the methods were of course improved. In England at about the time of the war with the American colonies, a Mrs. Paulet, who lived near the Bell Inn at Stilton, on the great north road from London to Edinburgh, was gaining fame for her cheese, still celebrated as Stilton. In the United States the first cheeses were made by the women in the farm houses of the early settlers. It was not until between 1850 and 1860 that factories for cheese making on a large scale were established.

They caused a heavy falling off of this activity on the farms, but recent years have brought a marked revival of the practice. However, homemade cheese shows wide variations in quality. This is largely due to a lack of uniformity and standarization in the process, and therefore it is worth while to outline approved methods.

Clean, Sweet Milk

To make a real cheese of first class quality, the milk must be clean and sweet and taken from normal cows in good health.

Immediately after milking the milk should be cooled to about sixty degrees. If this temperature cannot be reached, only the morning's milk should be used. Where the milk from one milking is not enough, the previous night's milk should be cooled also and mixed with the morning's milk. If the milk is of poor quality, the cheese also will be low-grade, regardless of the care used in the cheese making. Sourness in cheese may be caused by milk too high in acid or by failure to remove enough whey from the curd. This can be remedied by cooking at a higher temperature and cutting the curd into smaller pieces.

Bitter cheese is due to undesirable bacteria in the milk. A too open texture in the cheese is usually caused by pressing at a low temperature or not applying sufficient pressure to the curd. Pastiness in the cheese, usually accompanied by sourness, is apt to result from not firming the curd

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sufficiently and thus leaving in it an excess of whey.

Apparatus Required

Especially important in cheese making is an accurate thermometer. The temperature range is narrow, and keeping within this range is essential to high quality in the product. A five gallon container is suggested as a cheese vat, since a comparatively large quantity of milk will provide enough curd to maintain the proper temperatures. This is quite difficult with a small amount of curd. The most convenient shape of the container is rectangular, and it should be lined with heavy tin. If only a small quantity of cheese is to be made, a good wash boiler will answer the purpose. For cutting the curd in the vat into segments, a long piece of galvanized wire may be used, but factory-made horizontal and vertical curd knives are much more convenient.

A deep pan, rectangular in shape, with a hole punched in the bottom near one end, is needed for letting the whey escape. An old-fashioned roasting pan will do. For holding the curd while pressing it, a cheese hoop can be bought at low cost. An ordinary flatiron is used in making the hot iron test. An ordinary lard press is satisfactory as a cheese press. Cheese cloth is needed for bandages and unbleached muslin for cap cloths. If cheese is to be made regularly in quantities larger than necessary for the home table, it is advisable to obtain from a dealer in dairy supplies an outfit suitable in size for the amount of milk available.

Details of Cheesemaking

Fresh clean milk is usually low in acidity, and to obtain the proper degree, a small amount of "starter" is required. This can be obtained from most creameries, or can be made at home by allowing good milk to stand at a temperature of 70 degrees until a smooth curd has formed. The curd should be free from gas holes and there should be no whey. A pint of starter is needed for five gallons of milk. Color is added at the rate of about a spoonful to this same quantity of milk. It comes in tablet form, with directions as to its proper use.

The amount of rennet to be added is usually half a cheese rennet tablet dissolved in about four ounces of cold water for five gallons of milk. The diluted rennet is poured into the milk in a small stream and stirred continuously for two minutes. With enough rennet, the curd will be ready to cut in from twenty to twenty-five minutes.

The curd is cut when it will pull away from the sides of the vat by light pressure of the back of the hand. The first thickening will appear about ten minutes af-

ter the rennet has been added, and about fifteen minutes later the curd will be thick enough for cutting. It should be cut as evenly as possible into cubes about half an inch in size, First cut lengthwise into half-inch strips and then crosswise into strips of the same size. About three minutes after cutting begin to stir the curd gently to prevent it from matting together again. For this, it is best to use the hands. After about ten minutes of hand stirring, apply heat very gradually, raising the temperature about one degree every five minutes until it reaches from 98 to 102 degrees. The richer the milk the higher the desired temperature. The time required is from forty to sixty minutes, fresher milk taking the longer time. During the heating the curd should be stirred continuously and held at the final temperature with continual agitation until ready for the removal of the whey.

This should be done when the curd has contracted to about half its original size. It should be firm when pressed together with the hands and should show no tendency to stick together. When rubbed on a clean hot iron and drawn away the curd should show fiber threads. The whey can be removed either by dipping or pouring. A wooden rack with slats placed a half inch apart makes a good drain rack. Place a course muslin cloth over the slats and pour curd and whey on the rack. Keep the curd agitated by stirring with the hands. The free whey escapes.

Cheddaring

This is the main feature of this type of cheesemaking. When the free whey has drained from the cheese on the drain rack, remove the curd to the roasting pan. Care should be taken that the curd does not cool off during the draining and cheddaring process.

The curd is piled evenly in the roasting pan to a depth of from six to eight inches. Cut a small channel through the center of the cheese about two inches wide and lengthwise of the pan in order to allow the whey to drain towards the hole in the end of the pan. Spread the curd removed from the channel evenly on top of the curd on each side of the channel. The pan should be slightly tilted to facilitate rapid removal of whey.

In order to keep the cheese at a temperature of 98 degrees to 100 degrees F. during the cheddaring, place the pan containing the curd in the upper shelf of the stove oven and turn on enough heat to keep the cheese at a temperature of 98 degrees to 100 degrees F. It will require careful heat regulation to get desirable results. Too much heat will ruin the cheese. Place a pan on the bottom shelf of the oven to catch

the whey which will drip from the curd.

After the curd has finally matted together, which usually requires about twenty minutes, cut the curd into blocks about six to eight inches long and turn them over about every fifteen minutes and at the end of the third turning, pile the blocks of curd two deep. In another fifteen minutes repile three deep, unless the curd appears very moist. If it is moist, do not pile over two deep. In repiling always put the top block of curd on the bottom and the bottom on the top.

Keep the thermometer inserted in the curd during the cheddaring process and note that the temperature is kept above 90 degrees, and below 100 degrees F.

The cheddaring is completed when the curd shows strings from one-half to one and one-half inches long on the hot iron test. In either test the curd should tear apart like the breast meat of a chicken. When the curd reaches this stage, it is ready to mill or be cut up into small pieces about one-half inch wide by one to one and one-half inches long. This can be done readily with a butcher knife. After cutting the curd, stir it thoroughly until it does not mat together. Usually about fifteen minutes stirring is required before the curd is ready for salting.

The amount of salt to add to cheese depends upon several factors, chief of which is the amount of curd. Usually from two to three ounces of salt will be sufficient for the curd from five gallons of milk. The salt should be rather coarse and flaky.

Spread the curd on the bottom of the coaster and cool to 86-90 degrees. The salt should be put on in at least two applications. Stir the curd thoroughly after each application and give the salt time to dissolve. This will require from twenty to thirty minutes. After the salt is thoroughly dissolved the curd is ready for the press.

Pressing the Curd

While the salt is dissolving prepare the curd hoop. Line the hoop with clean cheese cloth, allowing a lap of about one inch on the side. The cheese cloth should extend about one-half inch below the bottom of the bucket to be used as a cheese hoop. Place one of the wooden followers on the bottom of the lard press or on the floor if an auto jack is to be used. Fold the bottom of the cheese cloth neatly over the top of this wooden follower and place a small cheese cloth circle over the neatly folded edges.

The curd should have a temperature of about 85 degrees at the time it is placed in the hoop. Press the curd into the hoop with the hands. Fold the top of the cheese cloth neatly over the top

of the cheese and place a wooden follower on top of the cheese.

A home-made lever press may be made of a plank or bar, one end of which is stuck under a piece of board and nailed on the wall while at the other end a weight is applied which may be moved in and out to regulate the pressure. The hoop is placed under the plank near the wall. It is important that the pressure is applied straight so as to make the cheese even and not one side lower than the other.

Apply pressure gradually until the whey runs freely. When the whey stops flowing, apply pressure until it starts flowing again. This gradual application of pressure is continued until no more whey flows from the curd.

Dressing the Cheese

After about forty-five minutes of constant pressure the curds should be firmly cemented together. Remove the curd hoop from the press and lift off the wooden follower. The cheese cloth bandage is gently pulled up around the cheese in order to remove any wrinkles that may have formed. The top is folded over and trimmed with the scissors to form a lap of one-half inch. Place a cheese cloth circle over the top of the cheese, replace the wooden follower, and apply full pressure for eighteen hours.

Drying and Paraffining

The cheese is taken from the press and placed in the curing room. The cheese should be placed on a clean board shelf and turned once each day. Wipe the board clean each time the cheese is turned. When the outside of the cheese is dry, it is ready to be paraffined.

The paraffin should be heated to a temperature of 210 to 220 degrees. The cheese should be turned on its side and slowly turned around until a smooth even coat of paraffin is applied. This is best accomplished by having the paraffin in a deep pan. After the paraffin has been applied to the sides of the cheese, then dip each end into the paraffin.

Curing the Cheese

One of the most difficult problems in the manufacture of farm cheese is to secure the proper curing facilities. Cheese should be cured at a temperature of from 50 to 55 degrees, and in addition the room in which it is cured should have a relative humidity of about 85. However, the room should not be damp. The curing process will take from six to twelve weeks, depending entirely upon the temperature of curing and the desired flavor. The longer the curing period, the more characteristic becomes the flavor of the cheese. The cheese should be turned at least once a week

during the curing period and if any mold growth appears, it should be washed off with a 10 percent formaldehyde solution.

In many cases it may be possible to secure space in a local cold storage plant, creamery, or milk plant. This would be the ideal method of curing the cheese, but will require a slightly longer curing period due to the lower temperature at which these storage rooms are usually kept.

Cottage Cheese

Take one gallon of sweet skimmilk, add three-fourths of a cup of clean, sour milk and stir as it is put in. Raise the temperature in hot water to 75 degrees, using a dairy thermometer. Remove from heat and place where it is to remain until set. Add one-eighth of a rennet tablet thoroughly dissolved in four tablespoonsful of cold water; stir while adding. Cover with cloth and leave from twelve to sixteen hours in even temperature, about 75 degrees. There should be a slight whey on the top and when poured out the curd should cleave sharply. Drain through cotton cloth, not cheesecloth. When whey has drained out, work in one or two teaspoonsful of salt to the cheese, according to taste. One and one-half to two pounds of cheese should be obtained from a gallon of milk.

Spray

Blood albumin, a by-product of the meat packing industry, has been found by the New York Experiment Station to be an excellent emulsifying agent for tank-mixed oil sprays to be used against insect pests of fruit trees. Besides its desirable emulsifying properties, it is moderate in cost, readily available, and easily handled.

Apple flea weevil has caused many Ohio apple orchards to become unprofitable. A control offered by the Ohio Agricultural Experiment Station consisted of absolutely clean orchard cultivation. Where this is impossible the suggested procedure is to spray in both the pre-pink and pink periods with the following formula: Kalo spray, Alorco, or Kryocide, 5 pounds; flotation sulfur powder, 8 pounds; Goulac, 3 ounces; and 100 gallons of water. Special care should be taken to cover the underside as well as the upper side of the leaves. In addition to controlling apple flea weevil, this treatment will control apple scab and will be of value in suppressing canker-worms and plum curculio.

—*Successful Farming*

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.

Breeding Your Own, or Raising Colts for Pleasure and Profit—By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.

Electricity in the Home and on the Farm, by Forrest B. Wright ($2.75). Published by John Wiley and Sons, Inc.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00. J. B. Lippincott Co. $5.00.

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State Col.; pub. by Collegiate Press. $2.50.

Farm Management and Marketing—By V. B. Hart, Ext. Professor of Farm Management; M. C. Bond, Ext. Professor of Marketing; L. C. Cunningham, Ext. Asso. Professor of Farm Management; all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. (1942). $2.75.

Fruit Crops—By T. J. Talbert, Prof. of Horticulture, Univ. Mo., and A. E. Murneek, Asst. Prof. Horticulture, Univ. Mo. Lea and Febiger. $3.75.

Hunger Signs in Crops—Published by the American Society of Agronomy and The National Fertilizer Review. $2.50.

Home Vegetable Gardening—By Charles S. Nissley, Extension Horticulturist in Vegetable Growing. Publ., Rutgers Univ. Press (1942). $1.50.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Judging Handbook—By Julius E. Nordby, Asst. Prof. Animal Husb., Univ. Idaho, Bu. Animal Industry, 1938, and W. Malcolm Beeson, Ph.D., Asst. Prof. Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Co. $4.00.

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.

Some Common Diseases of the Horse—By George R. Conn, B.S.A.H., D.V.M. Publ., Orange Judd Publishing Co., Inc. (1942). $1.50.

Some Common Diseases of Cattle—By George R. Conn, B.S.A.H., D.V.M. Publ., Orange Judd Publishing Co., Inc. (1942). $1.50.

The Nutgrowers Handbook—By Carroll D. Bush. Publ., Orange Judd Publishing Co. $1.75.

The Western Horse—Its Training, Type and Marketing. By John A. Gorman, Asso. Prof. Animal Production, Univ. of Wyoming. The Interstate Printers and Publishers. $1.65.

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw-Hill Book Co. $5.00.

For the convenience of our readers, books listed may be purchased through this Department. Address Farmers Digest, Ambler, Pa.

BRIEF BOOK REVIEW

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas.

The purpose of this book has been to present factual material, so analyzed and interpreted, that it will give individual farmers and Future Farmers a basis for developing sound practices and programs on their individual farms or ranches—regardless of the section of the South in which they are located. It is hoped that the book will serve as a guide in setting up and carrying on better beef cattle programs.

Mr. Williams is recognized as one of the South's, as well as the Nation's, authorities on beef cattle production. It was in recognition of his knowledge of the subject that he was invited to write this book.

Publishers: THE INTERSTATE Printers & Publishers (1941). $2.00.

INDEX

Beef Cattle

Herefords in New England ..... April, 1941
Choice Steers Return More Profit .. June, 1941
Crossbred Calves Make Good Beef . June, 1941
Cattle Experiments ..... July, 1941
Forage Beef ..... Aug., 1941
The Cow Herd ..... Sept., 1941
Calcium Needed in Fattening Rations, Oct., 1941
Type as a Factor in Judging ..... Nov., 1941
Wintering the Herd ..... Dec., 1941
Driving Chance Off the Range ..... Jan., 1942
Vitamins for Beef Cattle ..... Jan., 1942
How Permanent Is Type? ..... Mar., 1942
Prevention and Control of Calf Scours, Mar., 1942
Cow Housing Experiment ..... Mar., 1942
Feed Lot Equipment ..... April, 1942
Lower Beef Costs ..... May, 1942
Fitting Steers for Show ..... May, 1942
Why Creep Feed Calves? ..... June, 1942

Conservation

The Road Back to Soil Fertility .... Feb., 1941
What is Ecological Thinking? ..... Feb., 1941
Fencing to Fit Round Farming .... April, 1941
New Movement Takes Root ..... May, 1941
Hard Work, But No Hard Times .. June, 1941
Undercover Farming ..... June, 1941
Contour Lines ..... July, 1941
There's Probably a Good Farm Underneath, Aug., 1941
Cover Farming ..... Oct., 1941
Power Weed Burner ..... Oct., 1941
The Land and the People ..... Nov., 1941
An Anthology ..... May, 1942
Fence Row Facts ..... June, 1942

Crops

Inoculate Those Legumes ..... May, 1941
Red Fescue ..... May, 1941
The Magic Vine ..... May, 1941
What About Flax? ..... June, 1941
Corn Sprouts New Wings ..... June, 1941
To Fight Alfalfa Wilt ..... July, 1941
Making Soybean Hay ..... July, 1941
Lespedeza Takes Over ..... Aug., 1941
A New Legume-Lotus Corniculatus . Sept., 1941
One Man Looks at One Weed ..... Nov., 1941
Brome Grass ..... Nov., 1941
Piper Velvet Bent ..... Nov., 1941
Little Beans—Big Business ..... Dec., 1941
New System Farmer ..... Dec., 1941
New Control for Corn Ear Worms .. Dec., 1941
High Cotton Yields ..... Jan., 1942
Crop Insurance Dollars ..... Feb., 1942
Cotton Grown to Measure ..... Feb., 1942
Modern Rain Makers ..... April, 1942
Kudzu—Mender of Tattered Lands, April, 1942
Mystery Fiber Produced in Florida . April, 1942
Seed Treatment for Cereals and Corn, May, 1942
Which Forage Crops? ..... June, 1942
Fertilizing Corn ..... June, 1942
More Flax ..... June, 1942
New Crop for the South ..... June, 1942
Sudan Grass ..... June, 1942

Dairy Cattle

Progress in Breeding for Fat Tests . July, 1941
Making Veal from Dairy Calves ... Aug., 1941
Uniformity through Inbreeding ... Aug., 1941
What Price Breeding? ..... Aug., 1941
Improving Milk Through Feeds .... Aug., 1941
Red Umbrella Selling ..... Sept., 1941
The Four-Handed Milker ..... Sept., 1941
War on Mastitis ..... Sept., 1941
Early and Late Calving of Dairy Heifers, Sept., 1941
Peanut Meal as a Source of Protein . Oct., 1941
Influence of Processing on Milk .... Oct., 1941
Pasture Fly Trap ..... Nov., 1941
Factors Concerned in Efficient Milking, Nov., 1941
Effect of Shark-liver Oil on Milk Production, Dec., 1941
Calving Time ..... Dec., 1941
Ten Bull Battery ..... Jan., 1942
Preventing Cattle and Sheep Bloat .. Jan., 1942
Packers Want Top Veals ..... Jan., 1942
How Much Dairy Grain? ..... Jan., 1942
Trichomoniasis in Dairy Cattle ..... Jan., 1942
Breeding and Feeding Young Stock . Feb., 1942
Dairy Cattle Feeding ..... April, 1942
How Much Rent Can a Cow Pay? . April, 1942
Feeding the Herd Sire ..... May, 1942
Raising Calves When Milk Is Scarce . May, 1942
Rabbit Box Calf Pens ..... May, 1942
Artificial Udder Growth ..... June, 1942
Vitamin C for Sterility ..... June, 1942
Frequency of Milking and Production, June, 1942

Farm Machinery

Winter Care of the Tractor ..... Jan., 1941
Tractor Costs vs. Horse Costs .... April, 1941
Justifies Mechanization ..... April, 1941
Portable Lumber Harvester ..... Oct., 1941
You Can Ventilate That Stable ..... Jan., 1942
Tooling Up for Soil Conservation ... Jan., 1942
Speed in Farming ..... Jan., 1942
Bale-Chute Saves Labor ..... Jan., 1942
Farm Machinery in 1942 ..... Mar., 1942
The Most from a Gallon of Gas ... Mar., 1942
Push Button Barn Cleaning ..... Mar., 1942
How to Make the Mower Work Better, June, 1942
Device Saves Baling Wire ..... June, 1942
Good Tractor Care ..... June, 1942

Fruit

New Control for Peach Borer ..... July, 1940
New Orchard Culture ..... Sept., 1940
Storage and Transportation of Fruit . Nov., 1940
Safe Tractor Operation ..... Nov., 1940
Orchard Replacement ..... Dec., 1940
Controlled Atmosphere Storage .... Jan., 1941
Pruning Peach Trees for Early Production, Feb., 1941
Encouraging Trees to Root Deeply .. Feb., 1941
What Do Apples Cost? ..... March, 1941
4-Leaf Clover System of Pruning . March, 1941
Date Growing ..... April, 1941
The Papaya in Florida ..... May, 1941
Soil Management in Orchards ..... June, 1941
The Carob Tree ..... July, 1941
Growing and Drying Prunes ..... Aug., 1941
New Spray for Apples ..... Dec., 1941
Modifying Biennial Bearing in Apples, Jan., 1942
Planning a Nut Orchard ..... Jan., 1942
Is Your Sprayer Ready ..... Feb., 1942
Economy in Pruning ..... Mar., 1942

INDEX

Fertilizers

Phosphate Magic ..... Nov., 1940
More Plant Food per Ton ..... Jan., 1941
Nitrogen Industry Ready for Defense, April, 1941
Liquid Fertilizers ..... May, 1941
Potash Industry ..... June, 1941
Starter Solutions Modified ..... June, 1941
More about Liquid Fertilizers ..... June, 1941
Putting Plant Food to Work ..... July, 1941
Synthetic Wood Ashes Require Boron, Aug., 1941
A New Fertilizer Development ..... Aug., 1941
Limestone—A Fertilizer ..... Sept., 1941
Hunger Signs in Crops ..... Oct., 1941
Organic Matter ..... Nov., 1941
Calcium-Bearing vs. Neutral Fertilizers, Dec., 1941
It's the Calcium—Not the Alkalinity, Mar., 1942

Hay

Of 13 Ways of Making Hay ..... June, 1942

Hogs

Hogman's Headache ..... July, 1941
Breeding for Economy of Gains ... Aug., 1941
Improvement of Swine ..... Sept., 1941
A Ton of Pork ..... Oct., 1941
Swine Erysipelas ..... Oct., 1941
Brood Sow Testing ..... Nov., 1941
Streamlined Pork Production ..... Dec., 1941
Meat and Bone Scraps for Hogs .... Jan., 1942
Production Figures ..... Feb., 1942
Handsome Is as Handsome Does ... Feb., 1942
Increasing Pork Production ..... Feb., 1942
Sow Pregnancy Test ..... Mar., 1942
Pork Progress ..... April, 1942
Protein Supplements for Hogs .... April, 1942
Baby Pig Disease ..... May, 1942
Production Testing for Hogs ..... June, 1942

Horses

Shipping Horses ..... March, 1941
Coat Colors in Horses ..... April, 1941
Tests for Stock Horses ..... May, 1941
Horse Sleeping Sickness ..... July, 1941
Breeding Practices in the Remount Service, Jan., 1942
A Cutting Horse Must Be Good ... Mar., 1942
Remount Service Breeding Plan .. April, 1942
Watch Out for It ..... May, 1942
Power of the Horse ..... June, 1942

Pastures

They Tore Their Pastures to Pieces . July, 1941
Summer Care of Work Horses .... Aug., 1941
They Pasture the Orchard ..... Oct., 1941
How Ranchmen Make their Colts Gentle, Nov., 1941
Horse Breeding in China ..... Nov., 1941
New Pasture Grasses ..... Dec., 1941
Planning the Pasture System ..... Feb., 1942
A Pasture That Does Not Take Annual Leave ..... Feb., 1942
Grass Is Money ..... Feb., 1942
Pasture Champions ..... Mar., 1942
The Search for Better Grass ..... Mar., 1942
Good Pasture Management Pays .. April, 1942
Good Pasture Returns Dividends ... May, 1942
Planning the Use of Pasture ..... June, 1942

Poultry

Better Pullets on Range ..... July, 194
Analyze Your Costs ..... Aug., 194
Forty Million Broilers ..... Aug., 194
Out-of-Season Brooding ..... Sept., 194
Coolers Boost Egg Income ..... Sept., 194
Make Them Eat More Grain ..... Sept., 194
New Slants on Feeding ..... Sept., 194
Pullets Pay Big Rent for Crop Land . Sept., 194
Marketing 1,400 Turkeys at Retail .. Oct., 194
Methods and Rations for Fattening Poultry, Oct., 194
Why They Die ..... Nov., 194
Resistance and Immunity ..... Nov., 194
The Nittany Turkey ..... Dec., 194
Fowl Leukosis Battle ..... Dec., 194
Digestion of Poultry ..... Dec., 194
Calling All Farm Flocks ..... Jan., 194
Management for High Egg Production, Jan., 194
Does Heat for Layers Pay? ..... Feb., 194
Nutritive Requirements of Poultry .. Feb., 194
Barbecued Chicken ..... Mar., 194
Poultry Manure Is Worth Money .. Mar., 194
Saving Labor on the Poultry Farm . Mar., 194
Breeding in Step with Feeding .... Mar., 194
Selecting Breeders ..... April, 194
R.O.P. and the Progeny Test ..... April, 194
New Facts on Cannibalism ..... May, 194
Finding Substitutes ..... May, 194
Better Quality Eggs ..... June, 194
Dried Eggs ..... June, 194

Sheep

Soybeans for Lambs ..... Feb., 194
Modern Shepherds ..... Feb., 194
It Can Be Done ..... March, 194
Breeding for Consumers ..... April, 194
Cotton Coats for Sheep ..... June, 194
Quality Spring Lambs ..... July, 194
Ailments of Young Lambs ..... Aug., 194
The Karakul Industry ..... Oct., 194
Sheep and Wool in the West ..... Nov., 194
Lamb Credit per Ewe Weight ..... Dec., 194
Box-Type Lamb Brooder ..... Mar., 194
Sheep Production Programs ..... April, 194
Self-feeding of Fattening Lambs .. May, 194
How Much Roughage for Sheep? .. June, 194

Silage

Storing Grass Silage ..... Feb., 194
Place of Grass Silage ..... March, 194
Sweet Clover Silage ..... June, 194
New Methods for Grass Silage .... Sept., 194

Vegetables

What's New in Vegetable Gardening? May, 194
And a Few Potatoes ..... June, 194
Corn Earworms ..... June, 194
Spray Groups ..... June, 194
Lime Preferences of Plants ..... June, 194
High Quality Celery ..... July, 194
More Lime for Vegetables ..... Dec., 194
Growing Winter Rhubarb ..... Feb., 194
Tenants Share Garden ..... Feb., 194
What's New in Vegetables for 1942 . Mar., 194
How a Champion Grows Tomatoes . April, 194
Fertilizing for Better Vegetables ... May, 194
Should Potatoes Be Planted Thick or Thin?, May, 194

y, 194
., 194
., 194
t, 194
t, 194
t, 194
t, 194
t, 194
t, 194
try,
t, 194
v., 194
v., 194
c., 194
c., 194
c., 194
n., 194
,
n., 194
b., 194
b., 194
r., 194
r., 194
r., 194
r., 194
-ll, 194
-ll, 194
y, 194
y, 194
e, 194
e, 194
., 194
., 194
b, 194
l, 194
e, 194
y, 194
., 194
., 194
., 194
., 194
., 194
l, 194
y, 194
., 194
., 194
., 194
., 194
194
194
194
194
194
194
194
194
194
194
194
194
T.
194

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